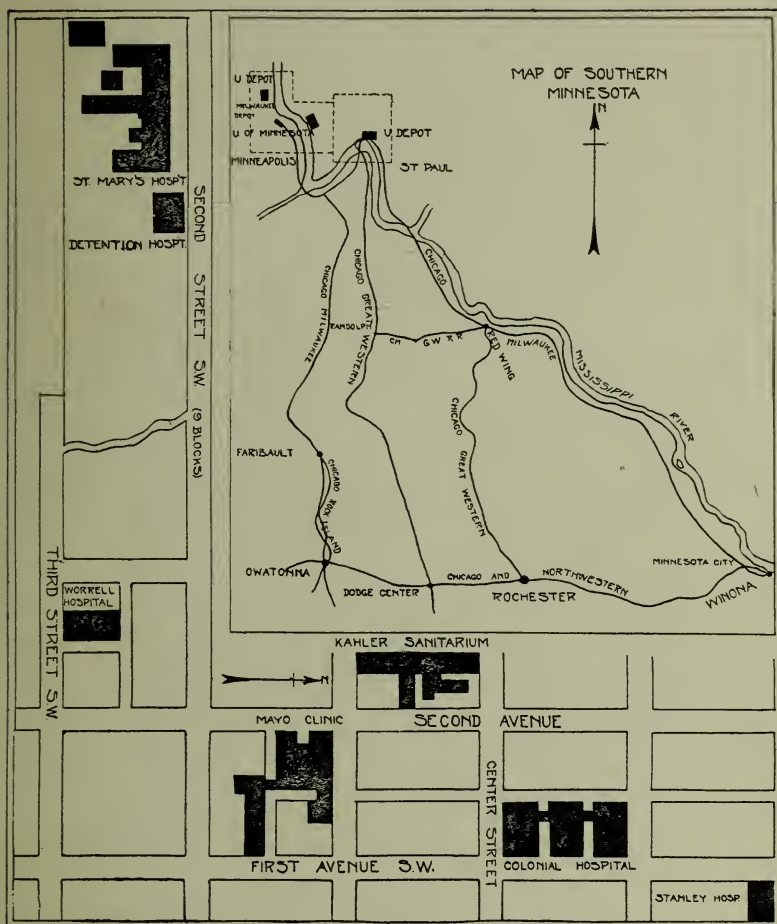


C. M66u2grm

1920/21



Map of a portion of Rochester showing clinics and hospitals serving the Mayo Foundation for teaching purposes

1920							1921													
JULY							JANUARY							JULY						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	1	2	3	..	..	..	..	..	..	1	..	..	..	..	1	2	..
4	5	6	7	8	9	10	2	3	4	5	6	7	8	3	4	5	6	7	8	9
11	12	13	14	15	16	17	9	10	11	12	13	14	15	10	11	12	13	14	15	16
18	19	20	21	22	23	24	16	17	18	19	20	21	22	17	18	19	20	21	22	23
25	26	27	28	29	30	31	23	24	25	26	27	28	29	24	25	26	27	28	29	30
..	..	..	..	..	..	..	30	31	..	..	..	..	..	31	..	..	..	..	..	..
AUGUST							FEBRUARY							AUGUST						
1	2	3	4	5	6	7	..	1	2	3	4	5	..	1	2	3	4	5	6	7
8	9	10	11	12	13	14	6	7	8	9	10	11	12	7	8	9	10	11	12	13
15	16	17	18	19	20	21	13	14	15	16	17	18	19	14	15	16	17	18	19	20
22	23	24	25	26	27	28	20	21	22	23	24	25	26	21	22	23	24	25	26	27
29	30	31	..	..	..	..	27	28	..	..	..	..	..	28	29	30	31	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SEPTEMBER							MARCH							SEPTEMBER						
..	..	..	1	2	3	4	..	..	1	2	3	4	5	..	..	..	1	2	3	4
5	6	7	8	9	10	11	6	7	8	9	10	11	12	..	4	5	6	7	8	9
12	13	14	15	16	17	18	13	14	15	16	17	18	19	11	12	13	14	15	16	17
19	20	21	22	23	24	25	20	21	22	23	24	25	26	18	19	20	21	22	23	24
26	27	28	29	30	..	..	27	28	29	30	31	..	..	25	26	27	28	29	30	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
OCTOBER							APRIL							OCTOBER						
..	..	..	..	1	2	..	..	..	..	..	1	2	..	..	..	..	..	1	2	..
3	4	5	6	7	8	9	3	4	5	6	7	8	9	2	3	4	5	6	7	8
10	11	12	13	14	15	16	10	11	12	13	14	15	16	9	10	11	12	13	14	15
17	18	19	20	21	22	23	17	18	19	20	21	22	23	16	17	18	19	20	21	22
24	25	26	27	28	29	30	24	25	26	27	28	29	30	23	24	25	26	27	28	29
31	..	..	..	..	..	..	..	..	..	..	..	..	..	30	31	..	..	..	..	..
NOVEMBER							MAY							NOVEMBER						
..	1	2	3	4	5	6	1	2	3	4	5	6	7	..	1	2	3	4	5	6
7	8	9	10	11	12	13	8	9	10	11	12	13	14	6	7	8	9	10	11	12
14	15	16	17	18	19	20	15	16	17	18	19	20	21	13	14	15	16	17	18	19
21	22	23	24	25	26	27	22	23	24	25	26	27	28	20	21	22	23	24	25	26
28	29	30	..	..	..	..	29	30	31	..	..	..	..	27	28	29	30	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
DECEMBER							JUNE							DECEMBER						
..	..	..	1	2	3	4	..	..	..	1	2	3	4	..	..	..	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11	4	5	6	7	8	9	10
12	13	14	15	16	17	18	12	13	14	15	16	17	18	11	12	13	14	15	16	17
19	20	21	22	23	24	25	19	20	21	22	23	24	25	18	19	20	21	22	23	24
26	27	28	29	30	31	..	26	27	28	29	30	..	..	25	26	27	28	29	30	31
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

# CALENDAR

1920-1921

1920

September	18	Saturday	Payment of fees closes, except for new students
September	20-25		Registration period, College of Science, Literature, and the Arts
September	21-28	Week	Examinations for removal of conditions, and entrance examinations Registration period, College of Agriculture, Forestry, and Home Economics
September	27	Monday	First semester evening extension classes begin
September	27-28		Registration days for all colleges not indicated above
September	28	Tuesday	Payment of fees for new students closes
September	29	Wednesday	Fall quarter begins, 8:30 a.m.
October	21	Thursday	Senate meeting, 4:30 p.m.
November	2	Tuesday	Election Day; a holiday
November	25	Thursday	Thanksgiving Day; a holiday
December	16	Thursday	Senate meeting, 4:30 p.m.
December	22	Wednesday	Fall quarter ends, 5:20
December	22	Wednesday	Christmas vacation begins, 5:20 p.m.

1921

January	4	Tuesday	Christmas vacation ends, 8:30 a.m.
January	4	Tuesday	Winter quarter begins, 8:30 a.m.
February	12	Saturday	Lincoln's Birthday; a holiday
February	17	Thursday	Senate meeting, 4:30 p.m.
February	22	Tuesday	Washington's Birthday; a holiday
March	24	Thursday	Winter quarter ends, 5:20 p.m.
March	24	Thursday	Spring vacation begins, 5:20 p.m.
March	30	Wednesday	Spring vacation ends, 8:30 a.m.
March	30	Wednesday	Spring quarter begins, 8:30 a.m.
May	19	Thursday	Senate meeting, 4:30 p.m.
May	20	Friday	Second semester evening extension classes close
May	30	Monday	Memorial Day; a holiday
June	12	Sunday	Baccalaureate service
June	14	Tuesday	Spring quarter closes, 5:20 p.m.
June	15	Wednesday	Forty-ninth annual commencement
June	17-18		Registration days for summer session
June	20	Monday	Summer session begins
July	30	Saturday	Summer session closes

# GRADUATE WORK IN MEDICINE

## ORGANIZATION

The graduate work in medicine in the Medical School and the Mayo Foundation is a part of the work of the Graduate School of the University. Its management is entrusted by the Board of Regents to a committee composed as follows:

The President of the University, LOTUS DELTA COFFMAN, Ph.D.

The Dean of the Graduate School, GUY STANTON FORD, Ph.D.

The Dean of the Medical School, ELIAS POTTER LYON, Ph.D., M.D., D.Sc.

The Director of the Mayo Foundation, LOUIS B. WILSON, M.D.

LEONARD G. ROWNTREE, M.D., D.Sc., of the Medical School and Mayo Foundation

JULIUS P. SEDGWICK, M.D., of the Medical School

CLARENCE MARTIN JACKSON, M.S., M.D., of the Medical School

JENNINGS C. LITZENBERG, B.S., M.D., of the Medical School

DONALD C. BALFOUR, M.D., of the Mayo Foundation

WILLIAM F. BRAASCH, B.S., M.D., of the Mayo Foundation

MELVIN S. HENDERSON, M.D., of the Mayo Foundation

## FACULTY

LOTUS DELTA COFFMAN, Ph.D., President

GUY STANTON FORD, Ph.D., Dean of the Graduate School

DONALD C. BALFOUR, M.B., M.D., Associate Professor of Surgery (Mayo Foundation)

ROY A. BARLOW, M.D., Assistant Professor of Rhinology and Oto-Laryngology (Mayo Foundation)

LEE W. BARRY, Ph.D., M.D., Assistant Professor of Obstetrics and Gynecology

RICHARD O. BEARD, B.S., M.D., Associate Professor of Physiology

ELEXIOUS T. BELL, B.S., M.D., Associate Professor of Pathology

WILLIAM L. BENEDICT, M.D., Associate Professor of Ophthalmology (Mayo Foundation)

WAYNE W. BISSELL, B.S., M.D., Assistant Professor of Pathology (Mayo Foundation)

WALTER M. BOOTHBY, M.A., M.D., Assistant Professor of Medicine (Mayo Foundation)

WILLIAM F. BRAASCH, B.S., M.D., Professor of Urology (Mayo Foundation)

EDGAR D. BROWN, Ph.D., M.D., Associate Professor of Pharmacology

FRANK E. BURCH, M.D., Associate Professor of Ophthalmology and Oto-Laryngology

RUSSELL D. CARMAN, M.D., Professor of Roentgenology (Mayo Foundation)



- J. FRANK CORBETT, M.D., Associate Professor of Experimental Surgery  
JOHN L. CRENSHAW, M.D.; Assistant Professor of Urology (Mayo Foundation)
- GEORGE B. EUSTERMAN, M.D., Associate Professor of Medicine (Mayo Foundation)
- BOYD S. GARDNER, D.D.S., Assistant Professor of Dental Surgery (Mayo Foundation)
- EMIL S. GEIST, M.D., Associate Professor of Orthopedic Surgery
- HERBERT Z. GIFFIN, B.S., M.D., Associate Professor of Medicine (Mayo Foundation)
- ARTHUR J. GILLETTE, M.D., Professor of Orthopedic Surgery
- ARTHUR S. HAMILTON, M.D., Professor of Mental and Nervous Diseases
- ERNEST M. HAMMES, M.D., Assistant Professor of Mental and Nervous Diseases
- THOMAS B. HARTZELL, D.D.M., M.D., Research Professor in Mouth Infections
- MELVIN S. HENDERSON, M.B., M.D., Professor of Orthopedic Surgery (Mayo Foundation)
- ARTHUR T. HENRICI, M.D., Associate Professor of Bacteriology
- ARTHUR D. HIRSCHFELDER, B.S., M.D., Professor of Pharmacology
- EDGAR J. HUENEKENS, M.D., Assistant Professor of Pediatrics
- CLARENCE M. JACKSON, M.S., M.D., Professor of Anatomy
- JOHN B. JOHNSTON, Ph.D., Professor of Comparative Neurology
- EDWARD S. JUDD, M.D., Professor of Surgery (Mayo Foundation)
- EDWARD C. KENDALL, Ph.D., Associate Professor of Biochemistry (Mayo Foundation)
- FRANCIS B. KINGSBURY, Ph.D., Assistant Professor of Physiologic Chemistry
- WINFORD P. LARSON, M.D., Professor of Bacteriology and Immunology
- ARTHUR A. LAW, M.D., Associate Professor of Surgery
- THOMAS G. LEE, B.S., M.D., Professor of Comparative Anatomy
- WILLIS S. LEMON, M.B., Assistant Professor of Medicine (Mayo Foundation)
- HAROLD I. LILLIE, B.A., M.D., Associate Professor of Otolaryngology, Rhinology, and Laryngology (Mayo Foundation)
- JENNINGS C. LITZENBERG, B.S., M.D., Professor of Obstetrics and Gynecology
- ARCHIBALD H. LOGAN, M.D., Associate Professor of Medicine (Mayo Foundation)
- ELIAS P. LYON, Ph.D., M.D., Professor of Physiology
- JESSE F. MCCLENDON, Ph.D., Associate Professor of Physiology
- WILLIAM C. MACCARTY, M.S., M.D., Associate Professor of Pathology (Mayo Foundation)
- ARTHUR T. MANN, B.S., M.D., Associate Professor of Surgery
- FRANK C. MANN, M.A., M.D., Associate Professor of Experimental Surgery and Pathology (Mayo Foundation)

- JAMES C. MASSON, M.D., Assistant Professor of Surgery (Mayo Foundation)
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- HENRY W. MEYERDING, B.S., M.D., M.S. in Orthopedic Surgery, Assistant Professor in Orthopedic Surgery (Mayo Foundation)
- ALEXANDER B. MOORE, M.D., Assistant Professor of Roentgenology (Mayo Foundation)
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- GORDON B. NEW, D.D.S., M.B., M.D., Associate Professor of Rhinology, Laryngology, and Stomatology (Mayo Foundation)
- HORACE NEWHART, B.A., M.D., Assistant Professor of Ophthalmology and Otolaryngology
- CHAUNCEY J. V. PETTIBONE, Ph.D., Assistant Professor of Physiologic Chemistry
- HENRY S. PLUMMER, M.D., Professor of Medicine (Mayo Foundation)
- ANDREW T. RASMUSSEN, Ph.D., Associate Professor of Neurology
- HAROLD E. ROBERTSON, B.A., M.D., Professor of Pathology
- EDWARD C. ROSENOW, M.D., Professor of Experimental Bacteriology (Mayo Foundation)
- LEONARD G. ROWNTREE, M.D., D.Sc., Professor of Medicine (Mayo Foundation)
- ARTHUR H. SANFORD, M.A., M.D., Associate Professor of Clinical Bacteriology and Parasitology (Mayo Foundation)
- RICHARD E. SCAMMON, Ph.D., Professor of Anatomy
- FREDERICK H. SCOTT, Ph.D., M.B., D.Sc., Professor of Physiology
- JULIUS P. SEDGWICK, B.S., M.D., Professor of Pediatrics
- WALTER D. SHELDON, B.S., M.D., Associate Professor of Medicine (Mayo Foundation)
- WALTER E. SISTRUNK, Phm.G., M.D., Associate Professor of Surgery (Mayo Foundation)
- LEDA J. STACY, M.D., Assistant Professor of Medicine (Mayo Foundation)
- JOHN H. STOKES, B.A., M.D., Associate Professor of Dermatology (Mayo Foundation)
- ARTHUR C. STRACHAUER, M.D., Professor of Surgery
- JOHN SUNDWALL, Ph.D., M.D., Professor of Hygiene
- ROOD TAYLOR, M.D., Ph.D. in Pediatrics, Assistant Professor of Pediatrics
- HENRY L. ULRICH, M.D., Associate Professor of Medicine
- S. MARX WHITE, M.D., Professor of Medicine
- RUSSELL M. WILDER, M.D., Ph.D., Assistant Professor of Medicine (Mayo Foundation)
- LOUIS B. WILSON, M.D., Professor of Pathology (Mayo Foundation)

- HENRY W. WOLTMANN, B.S., M.D., Ph.D. in Neurology, Assistant Professor of Neurology (Mayo Foundation)
- MAURICE B. BONTA, B.A., B.S., M.D., Instructor in Medicine (Mayo Foundation)
- ALBERT C. BRODERS, M.D., M.S., Instructor in Pathology (Mayo Foundation)
- H. CAREY BUMPUS, JR., Ph.B., M.D., M.S. in Urology, Instructor in Urology (Mayo Foundation)
- HARRY M. CONNER, M.D., Instructor in Medicine (Mayo Foundation)
- DORR F. HALLENBECK, M.D., Instructor in Medicine (Mayo Foundation)
- HOWARD R. HARTMAN, B.S., M.D., Instructor in Medicine (Mayo Foundation)
- VERNE C. HUNT, B.S., M.D., M.S. in Surgery, Instructor in Surgery (Mayo Foundation)
- JOHN DE J. PEMBERTON, B.A., M.D., M.S. in Surgery, Instructor in Surgery (Mayo Foundation)
- WILLIAM A. PLUMMER, M.D., Instructor in Medicine (Mayo Foundation)
- LEE W. POLLOCK, B.S., M.D., Instructor in Medicine (Mayo Foundation)
- FREDRICK A. WILLIUS, B.S., M.D., M.S. in Medicine, Instructor in Medicine (Mayo Foundation)

## GENERAL INFORMATION

The graduate work in medicine here outlined is not intended for those seeking brief practitioners' or review courses. Opportunities of this kind are to be found in the bulletin of the Medical School.

### HISTORY

In the fall of 1914, the University of Minnesota began graduate work in various fields of medicine and surgery in addition to that already offered for some time in the laboratory branches. The conditions laid down for this work as regards admission, residence, thesis, and examinations were those already applied by the Graduate School in approving all candidates for graduate degrees.

The training of medical graduates for special work in pathology, clinical medicine, and surgery by means of internships, residencies, and assistantships had been developed in the Mayo Clinic at Rochester, until in 1912 definite three-year services in these subjects for graduates in medicine, who had previously had one year's internship in a general hospital, were provided. These services were designated "fellowships," a term intended to cover internships, assistantships, residencies, etc. In order to perfect the organization and place the work on a permanent basis, February 9, 1915, a corporation, the Mayo Foundation for Medical Education and Research, was founded by Drs. William J. and Charles H. Mayo. On June 9, 1915, the University of Minnesota and the Mayo Foundation for Medical Education and Research entered into an agreement, by the terms of which the funds and income of the Mayo Foundation for Medical Education and Research are devoted, under the direction of the regents of the University of Minnesota, to the promotion of graduate work in medicine and to research in this field. On September 13, 1917, the funds and income of the Mayo Foundation were transferred entirely to the regents of the University.

### PURPOSE

In an age of specialization and the development of graduate work in all fields and phases of the sciences, letters, and arts, such educational work needs no elaborate justification. In a subject like medicine, intimately connected with established fields of research such as biology, chemistry, anatomy, physiology, pathology, and bacteriology, the need for scientific research and for the training of scientific specialists, investigators, and teachers is as great as in any subject, and of as vital importance.

The possibilities of such work hitherto have suffered less from neglect than they have from the lack of organization, standardization, and certification by the educational institutions which have found it possible and advisable to put such applied subjects as agriculture, education, engineering, and commerce upon a scientific basis, and have freely recognized the accomplishments of trained students by the granting of higher

earned degrees in these fields. In medicine in the United States, the leading specialists in practice and the trained productive investigators have usually been developed by long years in internships, minor teaching positions, hospital residencies, or personal apprenticeships to other specialists. A few have obtained their special training in general practice, gradually narrowing to a particular field. Many men in both groups have broadened themselves by visits to other laboratories and clinics for observation and by longer or shorter periods of foreign study. A much larger body of clinical specialists of varying attainments has been developed by so-called post-graduate or polyclinic medical courses or by the simple and convenient method of self-proclamation.

Taken as a whole, by such undirected processes graduate students are apt to waste time on unessentials and to acquire very inadequate knowledge of many of the essentials. In clinical branches such processes fail to provide any sure protection to the public against the untrained specialist or to open any avenue to the public's confidence for the properly trained specialist. And medical education, if it is to advance, must at least be able to supplement a faculty of skilled practitioners with men trained to carry forward the frontiers of medical science.

The objects of this graduate work in medicine are accordingly the training for medical practice of fully equipped and properly certified specialists and of investigators and teachers of medicine.

#### STANDARDS

In beginning its experiment in graduate work in medicine the University of Minnesota, in order to secure results and safeguard scientific standards, adopted those general policies and methods already indicated by the established graduate work in other sciences. The development has depended upon the maintenance of real standards of admission, the supply of qualified advisers to graduate students, the provision of adequate laboratory, clinical, and library equipment, and the institution of rigid tests in course and examinations in residence, with evidence of the power of productive research on the part of the student as evidenced in a thesis.

In doing this work the University of Minnesota is not seeking to multiply the opportunities for securing simply technical training through practitioners' courses. The graduate work is definitely intended to provide opportunities in three years of work for the well-prepared serious-minded student to fit himself in the science, as well as in the art of some special field of medicine or surgery. Entrance upon the work and continuance in it, as well as the holding of scholarships or fellowships in the Medical School or on the Mayo Foundation, will be strictly conditioned upon evidences of power and growth along scientific lines. The value of technical or mechanical skill as a practitioner or operator has its place, but will be subordinated to and measured by the power and product of the brain that guides the hand. From the standpoint of both the University and the prospective student it is highly important that this distinction in purpose be kept clearly in mind.



By the present arrangement of courses in arts, science, and medicine, a properly prepared student may enter the University, and in seven years secure the usual doctorate degree in arts, in science or in medicine. The object of the plan pursued at this University since 1914 is to provide three years of additional work on the basis of the degree of Doctor of Medicine, and leading to the special degrees of Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in Medicine, in Surgery, in Pathology, etc.

In clinical branches the degree of Master of Science is intended primarily to indicate scientific proficiency. To be recommended for this degree the candidate must have given evidence by two or three years of residence that he is competent to begin the practice of a clinical specialty in a scientific manner without the supervision of others. The Doctorate of Philosophy in clinical subjects will be given only to those men who have given evidence not only of proficiency at least equal to that required for the Master's degree, but who in addition present evidence of well-marked ability to advance medical science.

#### LABORATORY EQUIPMENT

The laboratory equipment for the prosecution of graduate work in medicine is located in Minneapolis, St. Paul, and Rochester.

The laboratory branches are well housed in excellently equipped buildings on the campus at Minneapolis and in Rochester. Anatomy, chemistry, pathology, and bacteriology are in modern University buildings especially designed for them. Physiology, physiological chemistry, and pharmacology are located in Millard Hall, a modern building of the best type. The laboratories for experimental medicine and surgery and extensive animal quarters are also in this building. The University museums of anatomy, pathology, and surgery contain a large number of specimens available for teaching purposes.

In Rochester the laboratories of general pathology, pathologic anatomy, clinical pathology, and bacteriology, experimental bacteriology, physiological chemistry, experimental pathology and physiology, electrocardiography, roentgenology, and photography are in the Mayo Clinic Building, as is also the pathologic working museum which contains over one hundred thousand specimens. The laboratory of surgical pathology is at St. Mary's Hospital. The metabolic laboratory is at the Colonial Hospital. A laboratory of physiologic chemistry is at the Stanley Hospital. A farm for experimental animals is maintained outside the city.

#### CLINICAL EQUIPMENT

The University owns and controls Elliot Memorial Hospital with its service building. This provides a clinic of 200 beds, and has the accumulated hospital records of nine years. The Out-Patient Department of the hospital is housed in Millard Hall and received 15,696 new patients and 65,528 patients' visits during the year ending June 30, 1920.

The State Hospital for the Crippled and Deformed at Phalen Park, St. Paul, offers the University full participation in its clinical opportunities.

The city hospitals of Minneapolis and the City and County Hospital of St. Paul, representing in all some 1,400 beds, exhibit every phase of clinical service in their wards and amphitheaters.

In Rochester, St. Mary's, the Colonial, Worrell, Stanley, and Curie Hospitals and the Kahler Sanitarium have an aggregate of about 1,300 beds with ten operating rooms for general surgery and two for diseases of the organs of the special senses. All patients are examined clinically in the Mayo Clinic Building and its annexes. In 1919, 60,645 patients were examined. In addition more than 350,000 clinical histories are on file and available for investigative studies. During 1919, 23,486 operations were performed.

Consent for postmortems is obtained in from 85 to 95 per cent of all patients dying in the clinic.

The working museum contains more than 100,000 pathologic specimens. All case histories and specimens are classified and arranged so as to be readily available for scientific research.

Arrangements have been made whereby fellows or other graduate students in medicine may divide their time, part of their work being taken in the Mayo Foundation at Rochester, and part in the Medical School at Minneapolis and St. Paul.

#### LIBRARIES

Besides the University Library and the departmental libraries, there are at the disposal of the student the general medical libraries in Millard Hall and the Mayo Clinic Building, and the collections of the Hennepin County and Ramsey County Medical Societies. Current issues and complete files of most important medical periodicals are available either in Minneapolis or Rochester.

#### METHODS OF STUDY

Every attempt is being made to establish the graduate work in medicine on a true University basis. Little class work is done. No short cramming courses are offered. The Mayo Foundation lectures at Rochester, and frequent special lectures at the Medical School, are given by men who are enthusiastically interested in their particular topics, but each lecturer presumes that his hearers are already well grounded in the fundamentals of his subject. Attendance at the lectures is purely optional with the graduate student. No quizzes are held and no examinations are given on the lectures. The same is true of the clinical and laboratory demonstrations and departmental seminars. Everything is done to impress the graduate student that his residence is an opportunity for him to find out things for himself and not a period in which he will be instructed by undergraduate methods. The student's work is carefully graded by his immediate chief whose duty it is to determine the student's ability by daily intercourse with

a smaller number of students rather than by class quizzes and formal examinations. Students holding fellowships who do not evince strong personal initiative will not be recommended for annual reappointment, or may be asked to resign their fellowships before the end of their period of appointment. In the arrangement of work the best opportunities will be consistently given to the best qualified men. Low-grade and mediocre men will not be permitted to continue to fill appointments to the exclusion of high-grade men.

#### REGISTRATION AND NUMBER OF STUDENTS

All students entering upon graduate work in medicine will register with the dean of the Graduate School. Students who begin their residence work in Rochester may fulfill the preliminary requirements by registering there with the director of the Mayo Foundation.

The number of graduate students who will be registered for work is determined by the clinical opportunities. This limitation applies to those doing their major work in clinical medicine and surgery and not to those majoring in the laboratory departments.

#### TUITION

The tuition fee for the graduate work in clinical medicine and surgery is \$30 per quarter. For students in the fundamental laboratory branches, the tuition fee is \$10 per quarter. Extra fees may be charged to cover the cost of materials and supplies for exceptional laboratory experimentation. The fees for graduate work in the summer session are stated in the special summer session bulletin. Fellows, scholars, and members of the teaching or scientific staff are exempt from tuition and fees.

#### FELLOWSHIPS AND SCHOLARSHIPS

Teaching fellowships in the Medical School are now established as follows: in surgery, 2; in internal medicine, 2; in obstetrics, 2; in ophthalmology and oto-laryngology, 2; in mental and nervous diseases, 2; and in pediatrics, 2. They carry a stipend of \$600 the first year, \$750 the second, and \$1,000 the third. These teaching fellows are required to devote their entire time (excepting an annual vacation of three weeks) to graduate work, including a small amount of teaching.

Similar teaching fellowships have been established in the fundamental laboratory department of the Medical School as follows: in anatomy (including histology and embryology), 3; in physiology and physiological chemistry, 1; in pharmacology, 1. These fellowships carry a stipend of \$500 the first year, \$1,200 the second, and \$1,500 the third year. They require a small amount of teaching, the remainder of the time being devoted to graduate work leading to advanced degrees.

In addition, there are at Minneapolis 5 scholarships, without stipend, carrying free tuition with opportunity for graduate study in any of the clinical departments.

The attention of prospective medical graduate students is also called to the Shevlin Fellowship in medicine yielding \$500 and tuition. Applications should be in the hands of the dean of the Graduate School before March 1.

The Mayo Foundation carries the following fellowships: in clinical and experimental surgery, 60; in orthopedic surgery, 4; in ophthalmology, 4, in rhinology and oto-laryngology, 8; in dental surgery, 4; in clinical and experimental medicine, 40; in neurology, 2; in dermatology, 4; in urology, 6; in roentgenology, 4; in pathology, 4; in bacteriology, 2; in chemistry, 2. The fellowships in clinical branches pay \$600 the first year, \$750 the second year, and \$1,000 the third year. The fellowships in fundamental branches pay \$900 the first year, \$1,200 the second year, and \$1,500 the third year. They require full time with an annual vacation of two weeks.

Nominations for fellowships on the Mayo Foundation are made each quarter, beginning with July 1, for residence to begin six months later or as vacancies occur. In the Medical School appointments are made as vacancies occur.

All appointments are made for one year and are renewable annually for a period of three years upon the basis of satisfactory progress in the work pursued. Requests for blanks for application for fellowships and scholarships should be addressed to the dean of the Graduate School, University of Minnesota, Minneapolis, Minnesota, or to the director of the Mayo Foundation, Rochester, Minnesota.

#### ASSISTANTSHIPS

A few qualified assistants designated as scholars and not candidates for degrees, may be accepted at Rochester in the laboratory and clinical branches for short periods. The number is necessarily limited in order not to interfere with the work of the resident fellows. Correspondence concerning this work should be directed to the director of the Mayo Foundation, Rochester, Minnesota.

Several of the departments in the Medical School (including anatomy, physiology, and pathology) have paid assistantships which may furnish means of self-support while the holder is pursuing graduate work. For further information, address the dean of the Medical School.

#### CLINICAL AND CLASS WORK FOR VISITING OR RESIDENT PRACTITIONERS

In order that there may be no misunderstanding, it should be stated that the graduate work for a limited number described above in no way changes or modifies the opportunities for observation hitherto extended visiting physicians and surgeons by the Mayo Clinic in Rochester, or the arrangements offered in Minneapolis by the Medical School for practitioners who wish to attend such undergraduate medical classes as may be of profit to them without interfering with the regular work of the staff and students of the Medical School. Inquiries concerning these opportunities should be addressed to the dean of the Medical School, Millard Hall, Minneapolis, Minnesota.



## SUMMARY OF REQUIREMENTS

The various steps involved in the requirements for the degree of Doctor of Philosophy (Ph.D.) in any one of the clinical or laboratory departments are briefly summarized in the following. The requirements for the Master's degree (M.A. or M.S.) are also indicated. Further information concerning graduate work in general may be found in the general Graduate School bulletin.

## REQUIREMENTS FOR ADVANCED DEGREES IN MEDICINE

1. *Selection.*—In the selection of graduate medical students, and in making appointments to fellowships for medical graduate work, preference will be given, other things being equal, to students who have done more than the usual amount of undergraduate medical work in the fundamental medical sciences (i.e., anatomy, physiology, pathology, etc.) through which they should make their approach to the specialty which they wish to take as a major subject.

2. *Admission.*—All graduate students are admitted by the dean of the Graduate School. Entrance upon work for the advanced degrees of Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in the clinical departments of medicine is limited to those who have: (a) the Bachelor's degree in arts or science, or its equivalent;\* (b) the degree of Doctor of Medicine from acceptable institutions (i.e., those in Class A of the American Medical Association); and (c) one year's experience as an intern in an approved hospital or as an assistant in a laboratory in an acceptable medical school. In the fundamental laboratory sciences (anatomy, physiology, bacteriology, pathology, and pharmacology) properly prepared students may be admitted without (b) and (c) as candidates for the Master's degree (M.A. or M.S.) or the Doctor's degree (Ph.D.).

Upon entrance to the Graduate School, the candidate, with the approval of the dean, will select his adviser in the field of his major work. With the approval of his adviser and the dean, he will outline a study program for the year, and if possible for the period of residence.

The study program for the second and third years is subject also to the approval of the Medical Group Committee.

3. *Residence.*—For the Doctor's degree (Ph.D.) at least three full years of successful graduate study are required, including certain special requirements noted below. For the Master's degree (M.S.) in clinical subjects, two or three years are required. For the Master's degree in the laboratory sciences a minimum of one year of residence is required.

4. *Language requirements.*—A reading knowledge of French and German in the field of the candidate's major must be certified by the professors in charge of these languages at least one year before the Doctor's degree is conferred, and before admission to the preliminary examination. The

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\* Students who have completed at least two years of pre-medical collegiate work, making an equivalent of the seven-years combined Arts-Medicine course at the University of Minnesota, are eligible for admission as graduate students.



candidate's adviser or his representative is expected to attend this examination and to furnish appropriate literature for the test. For the Master's degree in the laboratory sciences, a reading knowledge of one foreign language is also required, which must be certified before the end of the second quarter. For the Master's degree (M.S.) in the clinical branches, the language certificate is optional.

5. *Minor*.—With the approval of his adviser and the dean of the Graduate School, each student upon entrance selects a minor, which must be logically related to his major subject, and (for the Doctor's degree) must be completed by the end of the second year. The minor is preferably a laboratory subject in some other department, and should amount to not less than one sixth of the total work for the degree. At least one sixth of the work offered for the degree in a clinical subject should consist of graduate work in the fundamental laboratory branches, which will serve as a basis for the proposed clinical specialization. This fundamental work should be concentrated in the first part of the course so far as possible. The final examination in the minor for the Doctor's degree is included in the preliminary examination, as noted below. For the Master's degree no special examination is required in the minor, aside from the usual course examinations.

6. *Major*.—The major is that department in which the student desires to specialize. Together with the thesis, it should occupy at least two thirds of the total work for the degree. At least one year before attaining the Doctor's degree, the following procedure is required in order that the candidate may become eligible for the preliminary examination. In addition to the completion of the minor work and of the language requirement, he must have the written approval of the department committee (which includes the graduate faculty members) of the major subject. The statement of the department committee should include the subject of the special problem for the thesis, and should certify as to the ability of the candidate to meet all requirements for the degree sought. It should be based on the quality of the candidate's daily work in residence.

7. *Admission to candidacy*.—For the Master's degree, students who have met the language requirement, whose daily work in residence as indicated by quarterly grades, has been satisfactory and whose thesis subject has been properly approved, are admitted to candidacy at the end of the second quarter by vote of the Executive Committee of the Graduate School. For the Doctor's degree, the student is required to pass a preliminary examination, as noted below, before admission to candidacy.

8. *Preliminary examination*.—At least one calendar year before the Doctor's degree is conferred, a preliminary examination of the student shall be given by a committee appointed by the dean and including the student's adviser as chairman, a representative of the Medical Graduate Committee (other than the adviser) the head of his major department, a representative of the minor, and such additional members as the dean may consider necessary. Certificates of proficiency in French and German,

completion of the minor work and the recommendation of the major department shall be required before admission to this examination. The examination is in addition to the usual course examinations. It shall cover the graduate work previously taken by the student, *and may include any work fundamental thereto*. The examination may be either written or oral, or both, as determined by the examining committee. Only after the successful completion of this examination may the student be enrolled as a candidate for the Doctor's degree. Students failing to pass this preliminary examination shall not be reexamined until at least one quarter has passed.

9. *Thesis*.—Each candidate for an advanced degree (Master's or Doctor's) must submit a thesis. For the Master's degree, the subject of the thesis should be filed with the dean of the Graduate School by November 15. The subject must be approved by the adviser and by the Medical Graduate Committee. The topic should be within the field of the major, and the thesis should represent approximately half of a year's work of the student. The thesis must be written in acceptable English. It must show ability to work independently, give evidence of power of independent thought both in perceiving problems and in making satisfactory progress toward their solution. Familiarity with the bibliography of the special field and correct citation of authorities are expected.

The Master's thesis must be typewritten in triplicate, one copy on a special form of linen stock, the other two as carbon copies. Samples of the paper required should be examined in the dean's office. The three copies of the thesis must be filed in the dean's office not later than six weeks before graduation. The thesis will be examined by a committee appointed by the dean, on recommendation of the Medical Graduate Committee. Unanimous approval by the thesis committee is necessary for the acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the registrar, at least one week before commencement, the sum of one dollar for binding one copy of the thesis, which will be cataloged and deposited in the University Library.

For the Doctor's degree, a more elaborate thesis is required. The subject is to be stated in the written department recommendation, which precedes the preliminary examination at the end of the second year. The accumulation of material for the thesis should be started much earlier. The thesis must give evidence of originality and power of independent investigation. It must embody results of research forming a real contribution to knowledge and must exhibit a mastery of the literature of the subject and a familiarity with the sources of knowledge. The matter must be presented with a fair degree of literary skill.

The thesis must be typewritten in triplicate, to facilitate reading by the thesis committee. No special size or form is required for the Doctor's thesis, since it is to be printed subsequently. The three copies must be filed in the dean's office not later than six weeks before graduation. The dean will appoint a thesis committee with the student's adviser as chairman. Unanimous approval by this committee will be necessary for the

acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the registrar, not later than one week before commencement, a sufficient bond or such sum of money as will be required to print 100 copies of the thesis for the use of the University and as many additional copies as the candidate may require for himself. If the thesis is to be published elsewhere, reprints will be acceptable, if bound with covers in the special form required by the University.

10. *Final written examination.*—In addition to the usual course examinations in all subjects where such are given, the candidate for the Master's degree must pass a final written examination in the field of the major. (No *special* final examination is required in the minor.) The final written examination will be held not later than four weeks before commencement. It is given by the members of the graduate faculty in the major department, the adviser acting as chairman. This examination shall cover all the work done in the major, and may include any work fundamental thereto.

For the Doctor's degree, a final written examination in the major subject is similarly given, after the thesis is presented and at least four weeks before commencement.

11. *Final oral examination.*—If all other requirements for the degree have been met, including the final written examination and the acceptance of the thesis, the final oral examination will be held, not less than two weeks before commencement.

For the Master's degree, the adviser will act as chairman of the examining committee, which will include all the instructors with whom the student has taken work, the thesis committee, and ex-officio, the head or chairman of the department in which the major work is done. Any member of the graduate faculty may attend as a visitor, and written notice shall be sent by the chairman of the committee to all members of the Graduate Faculty in the major and minor departments. The final oral examination will cover all the work offered for the degree, and may include other work fundamental thereto. All final examinations for the higher degrees in medicine will include questions on the history of medicine with special reference to the candidate's major field. At the close of the examination, the committee will vote upon the candidate, taking into account all of his work. A majority vote is required for approval.

For the Doctor's degree, the committee conducting the final oral examination will consist of the adviser as chairman, of a majority of the members of the graduate faculty in the major department, and of at least three other members of the graduate faculty appointed by the dean. At least one member of this committee shall be from a group other than the one in which the major department is included. This examination is to cover the field of knowledge represented by the major work, and shall not exceed three hours. The date of the final oral examination for the doctorate shall be publicly announced, and the examination shall be open to any member of the graduate faculty. Upon completion of the

examination, a formal vote of the committee shall be taken and an affirmative vote of at least two thirds of the members shall be necessary for recommendation of the candidate for the degree.

12. *Recommendation by the faculty.*—The dean will report to the graduate faculty the names of those who have completed the requirements for the Master's and Doctor's degrees, and those duly approved will be recommended by the faculty to the Board of Regents of the University. Unless excused by the dean of the Graduate School and the president of the University, all candidates are required to be present at commencement when the degrees are conferred.

#### TABULAR SUMMARY OF REQUIREMENTS FOR THE MASTER'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
Program, major and minor	Adviser and dean of the Graduate School.	On entrance.
Approval of thesis subject	Adviser and group committee....	November 15.
Language requirement..	Adviser and language department.	Before close of second quarter.
Approval of candidacy..	Executive Committee.....	Beginning of third quarter.
Filing of thesis.....	Dean of the Graduate School....	Six weeks before graduation.
Examination of thesis...	Thesis committee.....	Before admission to final oral examination.
Final written examination in major.....	Major department members of the graduate faculty.....	Not later than four weeks before commencement and before final oral.
Final oral examination on all work.....	Thesis committee; all instructors; head of major department....	Not later than two weeks before Commencement.
(Course examinations as required at the usual time.)		
Fee for binding thesis...	Registrar .....	One week before commencement.

(For the Master's degree in clinical subjects, the dates refer to the last year.)

#### TABULAR SUMMARY OF REQUIREMENTS FOR THE DOCTOR'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
FIRST YEAR		
Major .....	Adviser and dean of Graduate	
Minor .....	School .....	
SECOND YEAR		
Tentative program of entire second and third year's work..	Adviser, Medical Graduate Committee and dean of Graduate School .....	Before beginning work of second year.
Major, including thesis	As for tentative program.....	
Minor .....	Adviser and minor department....	Before admission to preliminary examination.
Language .....	Adviser and language department.	One calendar year before degree is to be conferred.
Recommendation .....	By major department.....	
tion .....	Special committee.....	
Preliminary examina-		

# GENERAL INFORMATION

21

THIRD YEAR	WORK	UNDER THE DIRECTION OF	DATE
	Major, including thesis	Adviser, Medical Graduate Committee and dean of Graduate School .....	
	Filing of thesis.....	Dean .....	Six weeks before graduation.
	Approval of thesis....	Thesis committee.....	Before admission to final oral examination.
	Final written examination in major.....	Major department members of the Graduate Faculty.....	Four weeks before commencement and before final oral examination.
	Final oral examination	Adviser, majority of members of major department and other members appointed by dean of Graduate School .....	Not later than two weeks before commencement.
	Bond for publication of thesis .....	Registrar .....	Not later than one week before commencement.



## DEPARTMENTAL STATEMENTS

The members of the faculty at Rochester (Mayo Foundation) are indicated by an asterisk (\*) in the list at the head of each departmental statement. The courses given at Rochester are grouped separately, and the numbers given the special prefix "M." The suffixed f, w, s, and su indicate fall, winter, spring, and summer quarters, respectively. The hyphen indicates courses continuous through the quarters indicated. Suffixed letters separated by commas indicate the repetition of the course in the corresponding quarters. The courses numbered between 100 and 200 are less advanced in character, and in some cases are open as electives to properly qualified undergraduates. The courses above 200 are primarily graduate in character, of the more advanced or research type.

The various divisions are grouped under the following departments:

1. Anatomy (including histology and embryology)
2. Bacteriology and Immunology
3. Medicine (including general medicine, dermatology, and mental and nervous diseases)
4. Obstetrics and Gynecology
5. Ophthalmology and Oto-Laryngology
6. Pathology
7. Pediatrics
8. Pharmacology and Therapeutics
9. Physiology and Physiologic Chemistry
10. Roentgenology
11. Surgery (including general surgery, experimental surgery, orthopedic surgery, urology, and dental surgery).

### ANATOMY

Professors CLARENCE M. JACKSON, JOHN B. JOHNSTON, THOMAS G. LEE, RICHARD E. SCAMMON; Associate Professor ANDREW T. RASMUSSEN.

The Institute of Anatomy offers excellent facilities to students who wish to take advanced work or to pursue investigations in anatomy.

The prerequisite work for all students who desire a major or minor in the Department of Anatomy includes general zoology (animal biology), 6 semester hours, and advanced zoology or elementary courses in anatomy (including histology, embryology, and neurology), 6 semester hours. In addition, each student who desires a major in anatomy must have had the elementary courses in that branch of anatomy in which he desires to specialize—gross anatomy, histology, embryology, or neurology. Students majoring in clinical subjects who desire a minor in anatomy must have had the courses in anatomy usually required of medical students (including Courses 103, 107, and 111). A reading knowledge of either French or German is required of students who desire a major in anatomy for the Master's degree, and a reading knowledge of both French and German is required of those who are candidates for the Doctor's degree.

## COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

- 103s,su. HUMAN HISTOLOGY. A microscopic study of the various tissues and organs. Prerequisites: Animal Biology 1-2. Nine credits. SCAMMON.
- 107s,su. HUMAN EMBRYOLOGY. The development of the human body. Prerequisites: Anatomy 103, or equivalent. Six credits. SCAMMON.
- 111f,su. HUMAN NEUROLOGY. A study of the gross and microscopic structure of the central nervous system and sense organs of man. Prerequisites: Anatomy 103 and 107, or Animal Biology 9-10. Six credits. JOHNSTON, RASMUSSEN.
- 112f,w,s. COMPARATIVE NEUROLOGY OF VERTEBRATES. Prerequisites: Anatomy 111, or Animal Biology 27. JOHNSTON.
- 121f,s. ANATOMICAL TECHNIC. Lectures and laboratory work upon the principles and practice of microtechnic. Prerequisites: Anatomy 103, or Animal Biology 9-10. Three credits. LEE.
- 129f-130w-131s. TOPOGRAPHIC ANATOMY. Based upon a study of cross-sections of the human body. Lectures and laboratory work. Prerequisites: Anatomy 5-6-7. Two credits (or more) each quarter. JACKSON.
- 133f,su. ANATOMY OF THE FETUS AND CHILD. A survey of prenatal and postnatal development. Fourth-, fifth-, or sixth-year medical, or graduate students. Limited to sixteen students. Prerequisites: Courses 5-6-7, 107. Sixty-six hours, 4 credits. SCAMMON.
- 134f,w. ANATOMY OF THE NEW-BORN. A detailed laboratory study of the anatomy of the new-born. Fourth-, fifth-, or sixth-year medical, or graduate students. Prerequisites: Course 133, or equivalent. Sixty-six hours, 3 credits. SCAMMON.
- 135f,su. PHYSICAL DEVELOPMENT OF CHILDHOOD. Lectures, with study of illustrative material. Primarily for students in the College of Education; open to medical students by permission of instructor. Twenty-two hours, 2 credits. SCAMMON.
- 137f-138w-139s-140su. IMPLANTATION AND PLACENTATION. A study of the implantation of the ovum, the formation of the placenta and the earliest stages of development in man and mammals. Prerequisites: Anatomy 102 or equivalent. Three credits (or less). LEE.
- 149w. EXPERIMENTAL NEUROLOGY. A study of the morphology of the central nervous system by experimental methods. Prerequisites: Course 111. Three credits (or more). RASMUSSEN.
- 153f-154w-155s-156su. ADVANCED ANATOMY. Individual topics for advanced work in gross anatomy, histology, embryology, or neurology will be assigned to students who have completed the elementary courses in

the corresponding subjects. Special courses are arranged for clinical graduate students. JACKSON, JOHNSTON, LEE, SCAMMON, RASMUSSEN.

160f-162w-163su. SEMINAR IN GROWTH OF CHILDREN. A study with graphic analysis of data on physical development of children of school age. Prerequisites: Course 135, or equivalent. Hours and credits to be arranged. SCAMMON.

#### COURSES PRIMARILY FOR GRADUATE STUDENTS

201f-202w-203s-204su. RESEARCH IN ANATOMY. Qualified students may undertake the investigation of problems in anatomy, including histology, embryology, and neurology. Special facilities are offered to graduate students in the clinical departments for work upon problems in applied anatomy. JACKSON, JOHNSTON, LEE, SCAMMON, RASMUSSEN.

205f-206w-207s. ANATOMICAL SEMINAR. Reviews of the current literature and discussion of research work being carried on in the department. Reading knowledge of French and German required. JACKSON and staff.

#### BACTERIOLOGY AND IMMUNOLOGY

Professors WINFORD P. LARSON, EDWARD C. ROSENOW;\* Associate Professor ARTHUR H. SANFORD;\* Assistant Professor ARTHUR T. HENRICI; Instructor ANNE BENTON.

##### A. COURSES OFFERED AT MINNEAPOLIS

101f,su. SPECIAL BACTERIOLOGY FOR MEDICAL STUDENTS. The study of pathogenic bacteria, especially in relation to definite diseases; bacteriological methods in clinical diagnosis; principles of infection and immunity, with practical application of serum reactions. Fourth-year medical students and others. Prerequisite: general bacteriology. Sixty-six hours; 4 credits. LARSON and assistants.

105f. HOUSEHOLD BACTERIOLOGY. The decay, fermentation, and putrefaction of food-stuffs; molds; canning; bacterial food poisoning; bacteriology of the cleansing processes. Prerequisite: general bacteriology. Forty-four hours; 3 credits. BENTON.

114s. THE HIGHER BACTERIA. Study of morphology, cultivation, and classification of actinomycetes, yeasts, and molds. Study of the mycoses. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. HENRICI.

116w. COURSE IN IMMUNITY. Laws of hemolysis. Quantitative relationship between antigen and antibody. Wassermann reaction. Opsonins. Vaccines. Precipitin reaction. Blood grouping. Abderhalden reaction. Anaphylaxis. Fifth- and sixth-year medical students. Limited to ten students. Forty-four hours; 3 credits. LARSON.

- 117s. PATHOGENIC PROTOZOA. Study of parasitic protozoa in men, including spirochaets; their morphology and life histories; intermediate hosts as agents in the spread of disease; cultural methods. Prerequisites: general and special bacteriology; Animal Biology 45 and 107. Forty-four hours; 3 credits. LARSON.
- 118f. MORPHOLOGY AND TAXONOMY OF BACTERIA. Cytology of bacteria; their origin and systematic position; consideration of morphological, biochemical, and immunological characters as data for classification; variations and mutations in bacteria; the biometrical method as applied to bacteriology. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. HENRICI.
- 119f. BACTERIOLOGICAL CHEMISTRY. Chemical analyses of bacteria; physical agents influencing bacterial metabolism (salinity, hydrogen ion concentration, surface tension, etc.); factors stimulating enzyme production; protein, carbohydrate, and fat metabolism of bacteria; nitrogen fixation. Prerequisites: general and special bacteriology; physiological chemistry or phytochemistry. Sixty-six hours; 4 credits.
- 120w. CONTINUATION OF 119f. Bacterial toxins; "split proteins"; bacterial activity in the alimentary tract; pigment production; autolysis of bacteria; immunochemistry; permeability of bacterial cells; behavior of bacteria toward electricity. Sixty-six hours; 4 credits.
- 150f-151w (or 150w-151s). ADVANCED BACTERIOLOGY. An advanced course giving additional work in bacteriology and the opportunity of working out special problems. Limited to ten students. Forty-four hours; 3 credits. LARSON, HENRICI.
201. RESEARCH IN BACTERIOLOGY. Graduate students of the necessary preliminary training may elect research, either as majors or minors, in bacteriology. Hours and credits arranged. LARSON, HENRICI.
203. SEMINAR IN BACTERIOLOGY. One credit.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities for work in bacteriology and immunology in the Mayo Foundation are in connection with routine clinical examinations and in special research. They are most desirable as minors for fellows fitting themselves for clinical fields, as internal medicine, surgery, urology, and for fellows majoring in pathology, or as major subjects for fellows desiring to specialize in these fields.

The graduate courses in bacteriology are open to students with previous training in bacteriology, holding only their baccalaureate or Master's degrees in arts or science, as well as to graduates in medicine. They are designed to train well-equipped students for special work in bacteriologic diagnosis and research, and for the teaching of bacteriology.

M151f,w,s,su. CLINICAL BACTERIOLOGY. Making and examination of cultures; preparation and administration of autogenous vaccines; Wassermann tests; special clinical laboratory methods, and opportunity for clinical or bacteriological research. SANFORD.

M251f,w,s,su. EXPERIMENTAL BACTERIOLOGY. Research in the bacteriology of normal and diseased tissues, the blood, secretions, and exudates. Experimental inoculation of animals and immunological studies. Study of the therapeutic value of dead bacteria. ROSENOW.

## MEDICINE

(Including General Medicine, Dermatology, and Nervous and Mental Diseases)

Professors ARTHUR S. HAMILTON, THOMAS B. HARTZELL, HENRY S. PLUMMER,\* LEONARD G. ROWNTREE,\* S. MARX WHITE; Associate Professors GEORGE B. EUSTERMAN,\* HERBERT Z. GIFFIN,\* ARCHIBALD H. LOGAN,\* WALTER D. SHELDEN,\* JOHN H. STOKES,\* HENRY L. ULRICH; Assistant Professors WALTER M. BOOTHBY,\* WILLIS S. LEMON,\* ROBERT D. MUSSEY,\* LEDA J. STACY,\* RUSSELL M. WILDER,\* HENRY W. WOLTMANN;\* Instructors MAURICE B. BONTA,\* HARRY M. CONNER,\* DORR F. HALLENBECK,\* HOWARD R. HARTMAN,\* WILLIAM A. PLUMMER,\* LEE W. POLLOCK,\* FREDRICK A. WILLIUS.\*

The graduate work in the Department of Medicine is designed to prepare students for practice of the specialty of internal medicine, research in the problems of general medicine, and for the specialty of nervous and mental diseases, as the case may be. Prospective students who have had no special work in addition to that of the undergraduate course in physiology, physiologic chemistry, therapeutics, experimental medicine, or pathology are advised to devote a year or more to these subjects before entering the regular three years' graduate course. In addition, it is recommended that a minor be carried throughout the course in one or more of the following departments: Physiology, Pharmacology, Pathology, Immunology, and Pediatrics. For students specializing in nervous and mental diseases, minors in anatomy and psychology are especially valuable, and for those desiring it, a minor could be arranged in the Department of Ophthalmology and Oto-Laryngology, giving a special opportunity to study lesions of the eye occurring in systemic disorders. In the Medical School, during at least the third year of the three-year fellowship, the fellow acts as an officer of the clinic with definite responsibility in the care of patients in the University Hospital.

### A. COURSES OFFERED AT MINNEAPOLIS

121f,w,s,su. CLINICAL MEDICINE. Study of physical diagnosis and methods of investigation and recording clinical data. The laboratory of experimental medicine is open for study of special problems arising in the investigation of cases. Emphasis placed on methods of treatment. WHITE.



- 122f,w,s,su. DISEASES OF CARDIOVASCULAR APPARATUS. Special study of diseases of the heart and blood-vessels, including technic and application of the polygraph, electrocardiograph, and interpretation of outlines of the heart and great vessels obtained by means of the radiogram and orthodiagram. WHITE.
- 123f,w,s,su. PATHOLOGY OF THE NERVOUS SYSTEM. The preparation of gross and microscopic material from diseased nerve tissues; the relations existing between pathologic lesions, signs, and symptoms; the chief neuron systems and principles underlying their degeneration. HAMILTON.
- 124f,w,s,su. ADVANCED NEUROPATHOLOGY. A course consisting of several hours of demonstrations in papillo-edema and work of similar character, with study of the microscopic sections, etc. Opportunity for individual work for any desired period. HAMILTON.
- 125f,w,s,su. CLINICAL NEUROLOGY. Advanced diagnosis of nervous diseases; practical experience in diagnostic procedures employed in the study of diseases of the nervous system. The diagnosis and treatment of syphilis of the central nervous system. HAMILTON.
- 126f,w,s,su. NEUROLOGIC RESEARCH. HAMILTON.
- 127f,w,s,su. RESEARCH IN MOUTH INFECTIONS. A study of dental and paradental infections as related to systemic disease. Experimental study to determine the lesion produced in animals by bacteria from these sources. HARTZELL.
- 129f,w,s,su. PROBLEMS IN MEDICINE. Specific problems in diagnosis and treatment, including problems in immunology viewed from the clinical standpoint. ULRICH.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The work in internal medicine at Rochester consists of history-taking, physical examinations, the recommendation of patients for special examinations with correlation of results thereof, and the formation of independent judgments concerning diagnoses, and indications and recommendations for medical and surgical treatment, all under the immediate direction of the chief of the section and his associate or his first assistant. Each service consists of six half-days each week for six months (except as noted) in a clinical section. The alternate half-days are available for clinical demonstrations in other sections, the study and correlation of the literature, histories, specimens, etc., of selected groups of cases, and of experimental laboratory or other research work. A seminar is held at least once a week in each section for the discussion of the group of cases to which special attention is given in the section. Fellows majoring in internal medicine take a minimum of four services of six months each in chemical or laboratory diagnosis. Fellows majoring in surgery take a minimum of two services of six months each in diagnosis.

- M151f,w,s,su. LABORATORY OF HEMATOLOGY AND URINALYSIS. SANFORD.
- M152f,w,s,su. GASTROLOGICAL LABORATORY. EUSTERMAN.
- M153f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the gastro-intestinal and accessory digestive tracts. EUSTERMAN, HARTMAN.
- M154f,w,s,su. CLINICAL DEMONSTRATION of diseases of the gastro-intestinal and accessory digestive tracts. Twenty-four hours. Eusterman, HARTMAN.
- M155f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the intestines. LOGAN, POLLOCK.
- M156f,w,s,su. CLINICAL DEMONSTRATION of diseases of the intestines. Twenty-four hours. LOGAN, POLLOCK.
- M157f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the chest. LEMON, CONNER.
- M158f,w,s,su. CLINICAL DEMONSTRATION of diseases of the chest. Forty-eight hours. LEMON, CONNER.
- M159f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the blood and blood-forming organs. GIFFIN, BONTA.
- M160f,w,s,su. CLINICAL DEMONSTRATION of diseases of the blood and blood-forming organs. Twenty-four hours. GIFFIN, BONTA.
- M161f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the cardio-vascular system, ductless glands, and esophagus. H. S. PLUMMER, BOOTHBY, W. A. PLUMMER, WILLIUS.
- M162f,w,s,su. CLINICAL DEMONSTRATION of diseases of the thyroid. Twenty-four hours. H. S. PLUMMER, BOOTHBY, W. A. PLUMMER, WILLIUS.
- M163f,w,s,su. CLINICAL DEMONSTRATION of diseases of the cardio-vascular system and esophagus. Twenty-four hours. H. S. PLUMMER, WILLIUS.
- M164f-w,w-s,s-su,su-f. DIAGNOSIS AND RESEARCH (clinical and laboratory) in cardio-renal and vascular and metabolic diseases. ROWNTREE, WILDER.
- M165f,w,s,su. CLINICAL DEMONSTRATION of cardio-renal, vascular, and metabolic diseases. Twenty-four hours. ROWNTREE.
- M166f,w,s,su. CLINICAL DEMONSTRATION of pancreatitis and diabetes. Twenty-four hours. WILDER.
- M167f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of pelvic organs. MUSSEY.

- M168f,w,s,su. CLINICAL DEMONSTRATION of general medical and surgical cases. Twenty-four hours. MUSSEY.
- M169f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to gynecology. STACY.
- M170f,w,s,su. RADIUM THERAPY. STACY.
- M171f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to acute emergency conditions. HALLENBECK.
- M172f-w,w-s,s-su,su-f. GENERAL DIAGNOSIS IN NEUROLOGY AND PSYCHIATRY. SHELDEN, WOLTMANN.
- M173f,w,s,su. CLINICAL DEMONSTRATION of neurological diseases. Twenty-four hours. SHELDEN, WOLTMANN.
- M174f,w,s,su. GENERAL DIAGNOSIS with special reference to dermatology and syphilology. All day. STOKES.
- M175f,w,s,su. CLINICAL DEMONSTRATION OF DERMATOLOGIC AND SYPHILOLOGIC MATERIAL. Twenty-four hours. STOKES.
- M251f,w,s,su. ADVANCED WORK IN ELECTRO-CARDIOGRAPHIC LABORATORY. H. S. PLUMMER, WILLIUS.
- M252f,w,s,su. METABOLIC LABORATORY. Respiratory exchange, and allied physiologic problems. BOOTHBY.
- M253f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M153 or M155. Twelve hours. EUSTERMAN, HARTMAN.
- M254f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M156. Twelve hours. LOGAN, POLLOCK.
- M255f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M158. Sixty hours. LEMON, CONNER.
- M256f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M160. Twelve hours. GIFFIN, BONTA.
- M257f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M162, M251, or M252. Twelve hours. H. S. PLUMMER, BOOTHBY, W. A. PLUMMER, WILLIUS.
- M258f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M165. Twelve hours. ROWNTREE, WILDER.
- M259f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M167 or M171. Twelve hours. MUSSEY, HALLENBECK.

- M260f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M169 or M170. Twelve hours. STACY.
- M261f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M173. Twelve hours. SHELDEN, WOLTMANN.
- M262f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M175. Twenty-four hours. STOKES.
- M263f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies in nephritis, acidosis, diseases of the liver, and of the blood, together with research work along biochemical lines. ROWNTREE.
- M264f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies in nephritis and diabetes, together with research work along biochemical lines. WILDER.
- M265f,w,s,su. RESEARCH IN MEDICINE. ROWNTREE, WILDER.

### OBSTETRICS AND GYNECOLOGY

Professor JENNINGS C. LITZENBERG; Associate Professor FRED L. ADAIR;  
Assistant Professor LEE W. BARRY.

Of the courses in other departments open to graduate medical students, the following are especially recommended for those desiring to specialize in obstetrics and gynecology.

Advanced Anatomy; gross and histological, of the female generative organs (Anatomy 153f-154w-155s-156su)

Fetal Anatomy: dissection of fetus and new-born (Anatomy 133f and 134f,s,su)

Implantation and Placentation (Anatomy 137f,w,s)

Advanced Physiologic Chemistry (Physiology 153f,w,s,su)

Gynecological Pathology (Pathology 118s)

Experimental Pharmacology (Pharmacology 104, 109a,b)

Other courses in fundamental or clinical subjects may be elected.

The following graduate courses are offered in the Department of Obstetrics and Gynecology (at Minneapolis):

107f-108w-109s-110su. ADVANCED PATHOLOGY OF THE FEMALE GENERATIVE ORGANS. Required of first- or second-year fellows in obstetrics and gynecology. Prerequisite: Pathology 108, or equivalent. ADAIR.

111f-112w-113s-114su. CLINICAL OBSTETRICS AND GYNECOLOGY. A course in diagnosis and treatment, with special study of selected cases. Clinic in the Out-Patient Department of the University Hospital, MWF, throughout the year. Required of first-year fellows, and may be elected by second-year fellows. LITZENBERG, ADAIR, BARRY.

115f-116w-117s-118su. CLINICAL OBSTETRICS AND GYNECOLOGY. Similar to Course 111-114, but on TThS. Required of second-year fellows, and may be elected by first-year fellows. LITZENBERG, ADAIR, BARRY.

- 119f-120w-121s-122su. **ADVANCED OBSTETRICS AND GYNECOLOGY.** Includes service in the University Hospital, affording ample opportunity for experience in diagnosis, care, and treatment (operative and non-operative) of patients. Special facilities offered for study of problems and cases of unusual interest. Required of first-year fellows. LITZENBERG.
- 123f-124w-125s-126su. Similar to Course 119-122, but more advanced, both in clinical and research aspects of the subjects, so as to be adapted to the increased training and experience. Required of second-year fellows. LITZENBERG.
- 127f-128w-129s-130su. Similar to Courses 119-122 and 123-126, but more advanced. Required of third-year fellows. LITZENBERG.
- 201f-202w-203s. **SEMINAR.** A conference, including the fellows and graduate students. Presentation and discussion of original work and reports upon the current literature in obstetrics and gynecology. Reading knowledge of French and German is necessary. LITZENBERG.
- 205f-206w-207s-208su. **RESEARCH.** Clinical and laboratory research upon problems in obstetrics and gynecology. Required of third-year fellows, who must complete a satisfactory thesis during the year. Elective for second-year fellows or other properly qualified graduate students. LITZENBERG, ADAIR, BARRY.

### OPHTHALMOLOGY AND OTO-LARYNGOLOGY

Professor WILLIAM R. MURRAY; Associate Professors WILLIAM L. BENEDICT,\* HAROLD I. LILLIE,\* GORDON B. NEW,\* Assistant Professors ROY A. BARLOW,\* HORACE NEWHART.

The graduate courses in these subjects are designed to prepare selected men for advanced work in the various lines, to prepare them for practice in these specialties, and to develop research and productive work in these subjects.

Of elective courses in other departments, the following are highly desirable:

- Physics of Light and Acoustics
- Advanced Optics
- Advanced Anatomy of the Head and Neck
- Topographic Anatomy of the Head and Neck
- Advanced Histology and Embryology of the Eye, Ear, Nose, and Throat
- Advanced Physiology of Vision and Hearing
- Physiologic Optics Seminar
- Special Pathology of the Eye, Ear, Nose, and Throat
- Immunity
- Advanced Neuropathology

The following courses are offered within the department:



## A. COURSES OFFERED AT MINNEAPOLIS

- 124f. ANOMALIES OF THE OCULAR MUSCLES. BURCH.
- 125w. COURSES ON VISUAL FIELD: PERIMETRY. BURCH.
- 131f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE EYE. Demonstrations upon the cadaver and live and dead animal eyes, with the usual operative procedures of practical value. Each graduate student will perform all the usual operations upon the cadaver and animals. Two and one-half hours a week. MURRAY, BURCH, NEWHART.
- 132f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE NOSE AND THROAT. A course consisting of demonstrations upon the cadaver and the usual operative procedures of practical value. Each student will be given an opportunity to do work in the laboratory, performing all usual and practical operations. Two hours a week. MURRAY, NEWHART.
- 133f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE TEMPORAL BONE. A course of eight to twelve hours consisting of demonstrations and exercises on the cadaver at the Institute of Anatomy. Limited to four students. MURRAY, NEWHART.
- 134f,w,s,su. OPERATIVE SURGERY ON THE LABYRINTH. A course consisting of lectures and practical demonstrations of diagnostic methods. Eight hours; Millard Hall. MURRAY, NEWHART.
- 135f,w,s,su. ADVANCED COURSE IN REFRACTION WORK. A course consisting of eight lectures and illustrated demonstrations upon the errors of refraction and motor anomalies, supplemental and practical work in out-patient clinic on the refraction work. MURRAY, BURCH.
- 138f,w,s,su. ADVANCED OPHTHALMOSCOPY. Training in the use of the ophthalmoscope by (a) direct method, and (b) indirect method. Examination in detail of the normal fundus oculi. Diagnosis of abnormalities (a) in the media, (b) in the fundus oculi. MURRAY, BURCH.
- 139f,w,s,su. ADVANCED OPHTHALMOLOGY. Three years' service in the wards and Out-Patient Department of the University Hospital with clinic and laboratory research. Those taking this course will act as assistants in out-patient clinics in operative and other clinical work. MURRAY and assistants.
- 141f,w,s,su. ADVANCED OTO-LARYNGOLOGY. Three years' service in the wards of the University Hospital and Out-Patient Department with clinic and laboratory research. Those taking this course will act as assistants in out-patient clinics, in operative and other clinical work. MURRAY and assistants.
- 145f,w,s,su. CLINICAL OPHTHALMOLOGY AND OTO-LARYNGOLOGY. Special half-time assistantship and service in the private clinic of Associate

Professor Burch. A systematic course of assigned reading and study, with final examination, is included. For credit beyond one year, work in investigation must be included. BURCH.

146s. DIAGNOSIS AND THERAPEUTICS OF DISEASES OF THE EAR. NEWHART.

147f,w,s,su. PRACTICAL WORK IN REFRACTION. Prerequisite: Course 135. MURRAY, BURCH.

201f,w,s,su. SEMINAR IN OPHTHALMOLOGY AND OTO-LARYNGOLOGY. Given by members of the staff and open to fellows, scholars, and other properly qualified graduate students. MURRAY, BURCH, NEWHART.

203f,w,s,su. RESEARCH. Each graduate student will be required to pursue some line of original research in ophthalmology or oto-laryngology. MURRAY, BURCH, NEWHART.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

Fellows majoring in ophthalmology in the Mayo Foundation usually spend nine months on the physics of light, physiologic optics, and anatomy, pathology, and bacteriology of the eye. The remainder of their service is indicated by the other courses.

M151f,w,s,su. REFRACTION. Theory of refraction, retinoscopy, diagnosis of refractive errors of the eye, prescribing of lenses, practical work on patients under supervision of instructor. Shop work. PRANGEN.

M152f,w,s,su. OPHTHALMIC MYOLOGY. Eye movements, disturbances of motility of the eyes. BENEDICT, PRANGEN.

M153f,w,s,su. CLINICAL OPHTHALMOLOGY. External diseases of the eye, ophthalmoscopy, perimetry, ophthalmic surgery. Practical work with patients except surgical. BENEDICT.

M154f,w,s,su. MEDICAL OPHTHALMOLOGY. Ophthalmology in relation to general diseases, diseases of the nervous system and clinical diagnosis, advanced physiology of the eye, psychology of vision, functional eye disturbances. Lectures and demonstrations. Half-time. BENEDICT.

M155f. PHYSICS OF LIGHT. Physio'ogic optics. Lectures and demonstrations. BENEDICT.

M156f,w,s,su. CLINICAL DEMONSTRATION of diseases of the eye. Twenty-four hours. BENEDICT, PRANGEN.

NOTE: Pathology of the eye; lectures and demonstrations; laboratory facilities for research. Bacteriology of the eye; laboratory work; animal experimentation; laboratory facilities for research.

Fellows majoring in oto-laryngology and rhinology in the Mayo Foundation usually spend the forenoons of their first year as interns in the Worrell Hospital where they act as second assistants in the operating rooms, and

their afternoons in the examination of patients in the clinic. In the forenoons of their second year they are on out-patient service in the clinic, and in the afternoons they examine patients. In the forenoons of their third year they act as first assistants at operations in the Worrell Hospital and in the afternoon they examine patients. During this year they have special opportunity to do equilibration work. Preferably during their first or second years a minimum of six months is taken out of the above mentioned service for their minor, usually pathology or bacteriology.

MI51f,w,s,su. CLINICAL OTO-LARYNGOLOGY AND RHINOLOGY. Theory and practice with differential diagnosis of diseases of the ear, nose, accessory sinuses, pharynx, and larynx and their relations to general diagnosis. Half-time for one year. LILLIE, BARLOW.

MI52f,w,s,su. ADVANCED CLINICAL OTO-LARYNGOLOGY AND RHINOLOGY. Equilibration tests, clinical work in localizing brain lesions, differential diagnosis. Half-time for one year. LILLIE, BARLOW.

MI53f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. Internship, second assistantship in operating service in Worrell Hospital. Half-time for one year. LILLIE, BARLOW.

MI54f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. First assistantship in operative service in Worrell Hospital. Half-time for one year. LILLIE, BARLOW, LYONS.

### PATHOLOGY AND PUBLIC HEALTH

Professors HAROLD E. ROBERTSON, JOHN SUNDWALL, LOUIS B. WILSON;\* Associate Professors ELEXIOUS T. BELL, WILLIAM C. MACCARTY,\* ARTHUR H. SANFORD;\* Assistant Professors WAYNE W. BISSELL,\* THOMAS B. MAGATH;\* Instructor ALBERT C. BRODERS.\*

Graduate students who desire to take their major or minor work in pathology must present credits in the following subjects: physics, 8 credits; general and organic chemistry, 12 credits; zoology, 6 credits; and a reading knowledge of German.

In addition, students who elect their major work in pathology must present credits for the equivalent of the first two years' work of the Medical School of this University.

#### A. COURSES OFFERED AT MINNEAPOLIS

103su,w. PREVENTIVE MEDICINE AND HYGIENE. A systematic study of the principles of personal and communal hygiene and of general procedures for the protection of the public health. Thirty-three hours; 3 credits. SUNDWALL.

104f,w,s. AUTOPSIES. Technic of performing autopsies; making autopsy records; examination of fresh organs removed from these autopsies.

Opportunities afforded to study observed lesions microscopically. Three or four students called to each post-mortem; excused from regular classes. The staff.

#### ELECTIVE COURSES<sup>1</sup>

105. ADVANCED CLINICAL PATHOLOGY. Practical studies on spinal fluids, including colloidal gold and Nonne reactions, and other special methods for examination and diagnosis of body tissues and fluids.
106. PATHOLOGIC TECHNIC. General and special methods of preparation of microscopic and gross pathologic specimens; including practice with freezing microtome, celloidin and paraffin embedding methods, general and special stains, preparation of museum specimens, etc.
- 107f,w,s. APPLIED PATHOLOGY. Laboratory studies in the examination of routine operative and autopsy specimens, with investigation of special associated problems. Credit for work in this course is to be judged entirely by character and amount of work accomplished. Dates and hours arranged.
108. DIAGNOSIS OF TUMORS. The study of tumors and other pathologic conditions simulating tumor formation.
109. CLINICAL PATHOLOGICAL CONFERENCE. Presentation and comparison of clinical data on selected cases by clinicians, and of the pathological specimens from these same cases, by the pathologist, with discussions of the problems of etiology and diagnosis. One hour per week in each quarter.
- Electives in coöperation with the respective clinical branches. Studies of the pathologic conditions found in the diseases peculiar to each of the specialties listed below. Lesions demonstrated by gross and microscopic specimens.
110. GYNECOLOGICAL PATHOLOGY.
111. NEUROPATHOLOGY.
112. SURGICAL PATHOLOGY.
113. PATHOLOGY OF DISEASES OF THE EYE, EAR, NOSE, AND THROAT.
114. PATHOLOGY OF DISEASES OF CHILDREN.
115. PATHOLOGY OF DISEASES OF THE SKIN.
201. RESEARCH. Graduate students, of the necessary preliminary training, may elect research, either as majors or minors in pathology. Hours and credits to be arranged.

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<sup>1</sup> Elective courses offered in two, three, or four quarters. Special programs issued for each quarter. Assignment of elective courses to individual staff members will appear in quarterly programs.

## B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The graduate work in pathology offered in the Mayo Foundation is planned primarily to give opportunity to fellows majoring in clinical branches to study the pathological aspects of diseases in those fields in which they are specially interested. Opportunity is also offered for a small number of fellows to major in pathology with their minor in bacteriology, or vice versa.

MI51f,w,s,su. PARASITOLOGY. Routine clinical and special research in parasitology, examination of stools, study of internal parasites. MAGATH.

MI52f,w,s,su. CLINICAL PATHOLOGY. Making and examination of cultures, preparation and administration of autogenous vaccines, Wassermann tests, special clinical and laboratory methods including hematology and serology and opportunity for research. SANFORD.

MI53f,w,s,su. LABORATORY DEMONSTRATION of clinical laboratory methods. SANFORD, MAGATH.

MI54f-w,w-s,s-su,su-f. NECROPSY SERVICE. Junior assistant three months; senior assistant three months; demonstrations in clinico-pathologic conferences; microscopic examination of fixed tissues removed at necropsy and operations. BISSELL.

MI55f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at necropsy and operation. BISSELL.

MI56f-w,w-s,s-su,su-f. SURGICAL PATHOLOGY. Pathologic diagnosis of surgical specimens at operation, gross and microscopic; study of fresh tissues. MACCARTY, BRODERS.

MI57f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at operation. MACCARTY, BRODERS.

M251f,w,s,su. RESEARCH STUDIES IN SPECIAL PATHOLOGY; special pathology of various organs; gross and microscopic study of lesions; research work on assigned problems in the several fields. WILSON.

M252f,w,s,su. RESEARCH STUDIES upon the etiology of neoplasms and clinico-pathologic standardization. MACCARTY, BRODERS.

M253f,w,s,su. RESEARCH WORK on assigned problems in experimental pathology. MANN.

M254f,w,s,su. RESEARCH WORK in clinical pathology. SANFORD, MAGATH.

## PEDIATRICS

Professor JULIUS P. SEDGWICK; Associate Professor WALTER R. RAMSEY;  
Assistant Professors EDGAR J. HUENEKENS, ROOD TAYLOR.



The graduate work of the Department of Pediatrics is arranged with the intention (a) of preparing students to become competent pediatricists; (b) to put them in position to attack original pediatric problems; and (c) to make them competent teachers in the subject.

As a prerequisite a general understanding of physiologic and analytic chemistry and a working knowledge of French and German are essential.

Prospective students will find preparatory study in physiology and quantitative analysis of value.

Students will be encouraged to carry a minor in some of the fundamental branches.

#### COURSES OFFERED AT MINNEAPOLIS

The following electives in other departments are desirable. (For further information see description of courses under departmental headings.)

Quantitative Analysis

Organic Chemistry

Physical Chemistry

Mental Retardation

Physiologic Chemistry

Physiology of Muscle, Nerve, Blood, Circulation, and Digestion

Physiology of the Nervous System and Special Senses: Respiration,

Metabolism, Nutrition, and Excretion

Physical Chemistry of Cells

Electro-Physiology

Metabolism

Quantitative Methods

Human Neurology

Fetal Anatomy

General Roentgenologic Technic

Interpretations of Roentgenologic Findings

Hematology

Course in Immunity

The Physiological and Chemical Basis of Pharmacology (Pharmacology

113a,b)

Diseases of Cardio-vascular Apparatus (Medicine 123-124)

Medical Chemistry

Orthopedic Service

Orthopedic Diagnosis

Advanced Ophthalmoscopy

103f,w,s,su. CLINIC IN PEDIATRICS. Conducted at the University Hospital and the General Hospital; a part of course in required clinics. Sections of class. Fifth year. Eleven hours. SEDGWICK, HUENEKENS, and assistants.

104f,w,s,su. CONTAGIOUS DISEASES. The advanced study of contagious diseases, including the practice of intubation and tracheotomy, with training upon the cadaver.

## III. DISEASES OF THE NEW-BORN.

115. THEORY AND PRACTICE OF INFANT-FEEDING, including diseases of the gastro-intestinal tract.
117. PEDIATRIC CLINIC. Out-Patient clinic; University Hospital.
- 125f,w,s,su. SPECIAL GRADUATE CONTAGIOUS COURSE. Advanced study of contagious diseases, including practice of intubation with training upon the cadaver and the living dog. Limited to graduates. Two hours a week. TTh. General Hospital, 12:30 to 1:30.
- 127f,w,s,su. THESIS COURSE.
- 129f,w,s,su. PEDIATRIC SEMINAR.
- 130f,w,s,su. Course consisting of three to six months' residency in pediatrics. Contagious diseases at General Hospital.
142. PREPARATION OF INFANT FOODS. Practical work.
144. CONTAGIOUS DISEASES. Advanced study of contagious diseases.
- 200-201. ADVANCED STUDY IN DISEASES OF INFANTS AND CHILDREN.
- 202-203. RESEARCH IN DISEASES OF NEW-BORN. Students undertaking this work should have had the equivalent of Anatomy 115 and Pediatrics 111.
- 204-205. RESEARCH IN PHYSIOLOGY OF NEW-BORN. Prerequisites: General Pathology and Pediatrics 111. Prerequisite preparation in physiology will depend upon the type of work undertaken.
- 206-207. RESEARCH IN DISEASES OF INFANTS AND GROWING CHILDREN. Prerequisite work will depend upon the type of work undertaken.
- 208-209. RESEARCH IN PHYSIOLOGY OF INFANTS AND GROWING CHILDREN. Prerequisite preparation will depend upon the type of work undertaken (Physiology 203-204 or 205-206).
- 210-211. RESEARCH IN ANATOMY OF INFANTS AND GROWING CHILDREN. Prerequisite preparation will depend upon the type of work undertaken.

## PHARMACOLOGY AND THERAPEUTICS

Professor ARTHUR D. HIRSCHFELDER; Associate Professor EDGAR D. BROWN.

- 102s. GENERAL PHARMACOLOGY. The principles underlying the structure, physico-chemical properties, physiologic, therapeutic, and toxic actions of substances, natural or synthetic, used as medicines. At least one quarter of physiology is prerequisite. Thirty-three hours. HIRSCHFELDER, BROWN.

- 104s. EXPERIMENTAL PHARMACOLOGY. Exercises illustrating the preparation and actions of medicine, their relation to chemical structure and their mode of administration. At least one quarter of physiology is prerequisite. Sixty-six hours. HIRSCHFELDER, BROWN.
- 105su,f or w,s. GENERAL PHARMACOLOGY AND THERAPEUTICS. A more detailed study of drugs important in clinical practice, covering the relations of chemical structure to physiologic and therapeutic action and modes of application in clinical medicine. Sixty-four hours. HIRSCHFELDER, BROWN.
109. PHARMACOLOGICAL PROBLEMS. Special investigations and experimental study of one or more of the following topics: anesthetics; circulatory stimulants and depressants; drugs acting upon the kidneys; urinary antiseptics; poisons and antidotes; effects of common harmless drugs; internal secretions; action of drugs upon parasites, tumors, etc. Hours and credits by arrangement. HIRSCHFELDER, BROWN.
110. POISONS. Their detection, actions, and antidotes. Forty-eight hours. BROWN.
112. PRACTICAL MATERIA MEDICA. The study of crude drugs, pharmaceutical preparations, and the flavoring and compounding of prescriptions. Eight hours. BROWN.
- 113f. THE PHYSIOLOGICAL AND CHEMICAL BASIS OF PHARMACOLOGY. The relation of drug action to chemical structure; the mode of action and therapeutic application of various synthetic drugs; the study of chemotherapy. An adequate training in chemistry is prerequisite. Twenty-two hours. HIRSCHFELDER.
- 201f,w,s,su. SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY. Reviews of recent literature bearing upon physiologic and pharmacologic subjects. Conducted by department directors, with the collaboration of the staffs and of qualified graduate or undergraduate students. Thirty-two hours.
- 203f,w,s,su. RESEARCH IN PHARMACOLOGY. HIRSCHFELDER, BROWN.

### PHYSIOLOGY AND PHYSIOLOGIC CHEMISTRY

Professors ELIAS P. LYON, JESSE F. McCLENDON, FREDERICK H. SCOTT; Associate Professors RICHARD O. BEARD, EDWARD C. KENDALL;\* Assistant Professors FRANCIS B. KINGSBURY, CHAUNCEY J. V. PETTIBONE.

The Department of Physiology is well equipped for the various types of physiologic investigation. The library facilities are good.

For a minor or major in physiology, good courses in general zoology, general chemistry, organic chemistry, and college physics, are prerequisites. (In exceptional cases high-school physics may be accepted for a minor.) Physical chemistry is desirable.

For a minor or major in physiologic chemistry, general and organic chemistry is prerequisite, and physical chemistry is desirable.

In addition, each student majoring in physiology or physiologic chemistry must have had the general courses, Physiology 100, 101, 103, 104, or the equivalent.

Students majoring in clinical subjects, and who desire to minor in physiology or physiologic chemistry, must have had the courses in these branches usually required of medical students.

A reading knowledge of German or French is required of candidates for the Master's degree in this department, and a reading knowledge of both French and German, of candidates for the Doctor's degree.

#### A. COURSES OFFERED AT MINNEAPOLIS

100f,su-101w,su. **PHYSIOLOGIC CHEMISTRY.** The components of the animal body; foods, digestion, the excreta and metabolism. Third-year medical students and others. Prerequisite: organic chemistry. One hundred ninety-eight hours; 12 credits. KINGSBURY, PETTIBONE, GREISHEIMER.

103f,su. **PHYSIOLOGY OF MUSCLE, NERVE, BLOOD, CIRCULATION, AND DIGESTION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. SCOTT, McCLENDON, and Assistants.

104w,su. **PHYSIOLOGY OF THE NERVOUS SYSTEM AND SPECIAL SENSES; RESPIRATION, METABOLISM, NUTRITION, AND EXCRETION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. LYON, SCOTT, BEARD, McCLENDON.

#### ELECTIVE COURSES

110f. **PHYSICAL CHEMISTRY OF VITAL PHENOMENA.** Osmotic pressure, surface tension, electric conductivity, hydrogen-ion concentration, bio-electric currents, negative osmosis. Prerequisites: animal biology and two courses in chemistry. Sixty-six hours; 3 credits. McCLENDON.

111w. **MINERAL METABOLISM.** Function of inorganic constituents of the body and changes in mineral metabolism in disease. Prerequisite: 110f or arrange. Sixty-six hours; 3 credits. McCLENDON.

112s. **VITAMINES.** Physico-chemical conditions necessary for the preservation of the vitamins during the storage, cooking, or other preparation of foods. Prerequisite: 111w. Sixty-six hours; 3 credits. McCLENDON.

113f,w,s,su. **PROBLEMS IN PHYSIOLOGY.** Arranged by instructors with qualified students. Each student will be assigned a topic for special laboratory study, leading in some cases to original investigation. Conferences and reading. Prerequisites: Courses 103-4 or equivalent. Sixty-six hours; 3 credits or arrange. LYON, SCOTT, McCLENDON, GREISHEIMER.

131w. **ADVANCED PHYSIOLOGY OF MUSCLE, BLOOD, CIRCULATION, AND DIGESTION.** Alterations due to physiologic conditions. Prerequisite: Physiology 103. Sixty-six hours; 3 credits. SCOTT.

- 132s. **ADVANCED PHYSIOLOGY OF RESPIRATION, EXCRETION, METABOLISM, NERVOUS SYSTEM, AND SENSE ORGANS.** Conferences and laboratory work. Prerequisite: Physiology 104. Sixty-six hours; 3 credits. SCOTT.
- 137f,s. **FOODS AND PRACTICAL DIETETICS.** A study of human foods and foods values; of the principles of food selection; of caloric indices and balanced dietaries. Exercises in the practical preparation of foods. Prerequisite: physiologic chemistry. Limited to twelve students. Sixty-six hours; 3 credits. BEARD.
- 138w. **PHYSIOLOGY OF DEVELOPMENT.** The physiology of the ovum, embryo, fetus; the functions of menstruation, ovulation, pregnancy, parturition, and lactation; the functional characteristics of birth, infancy, childhood, adolescence, maturity, and old age. Prerequisite: Physiology 103-4. Twenty-two hours; 2 credits. BEARD.
- 153f,w,s,su. **ADVANCED PHYSIOLOGIC CHEMISTRY.** Course arranged by instructors with qualified students for special work. May be taken one or more quarters. Prerequisite: Course 100-101. Hours and credits arranged. KINGSBURY, PETTIBONE.
- 161f. **URINALYSIS.** Advanced methods. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. PETTIBONE.
- 162f,w. **CHEMICAL ANALYSIS OF BLOOD.** The most recent methods in chemical analysis of blood. Limited to twelve students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. PETTIBONE, KINGSBURY.
- 163s. **METABOLISM.** Lectures and laboratory work on special phases of metabolism. Lectures may be taken alone; number of students unlimited; laboratory course limited to ten students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. PETTIBONE.
- 201f,w,s. **SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY.** For instructors and advanced students. Eleven hours; 1 credit. LYON, HIRSCHFELDER, and staff.
- 203f,w,s,su. **RESEARCH IN PHYSIOLOGY.** Hours and credits arranged. LYON, SCOTT, McCLENDON.
- 205f,w,s,su. **RESEARCH IN PHYSIOLOGIC CHEMISTRY.** Hours and credits arranged. KINGSBURY, PETTIBONE.
- 208f. **SEMINAR IN PHYSIOLOGIC OPTICS.** For graduate students and sixth-year medical students. Twenty-two hours; 2 credits. LYON.
- 210f. **PHYSIOLOGIC OPTICS.** A laboratory course. For graduate and sixth-year medical students. Thirty-three hours; 1 credit. LYON.



## B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

M251f,w,s,su. **PHYSIOLOGIC CHEMISTRY.** Research work in problems related to metabolism; includes training in the use of methods of organic and inorganic analysis. KENDALL.

NOTE: For course in applied physiology, see announcement of the Department of Surgery.

## ROENTGENOLOGY

Professor RUSSELL D. CARMAN;\* Assistant Professor ALEXANDER B. MOORE.\*

The opportunities offered in roentgenology in the Mayo Foundation are designed to permit selected men to fit themselves for advanced work in this specialty. The courses are also especially valuable for men who take them as minors in their preparation for special clinical fields. Unless the prospective student's preparation in normal anatomy, physiology, and pathology has been unusually good, at least a year should be spent in intensive study of these subjects before entering on the special three years' course.

M151f,w,s,su. **GENERAL ROENTGENOLOGIC TECHNIC.** Roentgenography; plates, intensifying screens, developers; stereoscopy; roentgenoscopy; vertical, horizontal. CARMAN, MOORE.

M155f,w,s,su. **SPECIAL APPLICATION OF ROENTGENOLOGY.** The osseous system, chest and lungs, urinary system, pyelography; gastro-intestinal tract. CARMAN, MOORE.

M159f,w,s,su. **ROENTGEN THERAPY.** Superficial, deep; technic; apparatus; filters; dosage and measurements; cross firing; protection. CARMAN, MOORE.

M163f,w,s,su. **DANGERS OF THE ROENTGEN RAY.** Effect upon tissues, normal and pathologic; protection, operator, patient; roentgen dermatitis, cause, results, treatment. CARMAN, MOORE.

M251f,w,s,su. **ELECTROPHYSICS.** Electricity and magnetism, phenomena, nature, and properties; source of electric energy; types of currents, continuous and alternating; units of electric measurement; resistance; Ohm's law; voltage, amperage, and wattage; the static machine; the induction coil; interrupters; condensers; the interrupterless transformer. CARMAN, MOORE.

M255f,w,s,su. **PHYSICS OF THE ROENTGEN RAY.** History, nature and phenomena; the vacuum tube; the roentgen tube; types, penetration, measurements. CARMAN, MOORE.

M257f,w,s,su. **INTERPRETATION OF ROENTGENOLOGIC FINDINGS.** Normal, abnormal; roentgen signs of disease, direct, indirect; correlation of plate and screen observations; correlation of clinical and roentgen findings. CARMAN, MOORE.

## SURGERY

(Including General Surgery, Experimental Surgery, Orthopedic, Urology, and Dental Surgery Divisions)

Professors WILLIAM F. BRAASCH,\* ARTHUR J. GILLETTE, MELVIN S. HENDERSON,\* EDWARD S. JUDD,\* CHARLES H. MAYO,\* ARTHUR C. STRACHAUER; Associate Professors DONALD C. BALFOUR,\* J. FRANK CORBETT, ARTHUR A. LAW, ARTHUR T. MANN, FRANK C. MANN,\* HARRY P. RITCHIE, WALTER E. SISTRUNK;\* Assistant Professors JOHN L. CRENSHAW,\* BOYD S. GARDNER,\* EMIL S. GEIST, JAMES C. MASSON,\* HENRY W. MEYERDING;\* Instructors HERMON C. BUMPUS,\* VERNE C. HUNT,\* JOHN D. PEMBERTON.\*

## A. COURSES OFFERED AT MINNEAPOLIS

- 101f,w,s. ADVANCED MINOR SURGERY. The student is required to assist in the dispensary (out-patient) surgical clinic, and in this connection makes a special study of the diagnosis and treatment of selected cases. STRACHAUER.
- 102f,w,s. OPERATIVE SURGERY ON THE CADAVER. The technic of abdominal incision and closure; of bowel suturing, appendix removal, kidney exploration, nephrotomy, tracheotomy, amputations, ligations, etc. Graduate students act as laboratory assistants, and may work out upon the cadaver various independent problems in emergency surgery. CORBETT.
- 103f,w,s. EXPERIMENTAL SURGERY. A study of surgical technic by cardinal operations upon animals. CORBETT.
- 104w. LOCAL ANESTHESIA. Methods and application of local anesthesia in both major and minor surgery. STRACHAUER.
- 105f,w,s. PROCTOSCOPY AND SIGMOIDOSCOPY. The treatment of the pathological conditions found in the lower bowel, including minor surgical operations. STRACHAUER.
- 201w,s. SURGERY OF THE KIDNEY. Review of the embryology, anatomy, and pathology. Diagnosis, cystoscopic study, including kidney function estimation and pyelography. Operative technic. Study of special problems involved. STRACHAUER.
- 204w,s. SURGERY OF THE BRAIN AND SPINAL CORD. Operative technic. Study of special problems involved. Prerequisites: Anatomy 103, Medicine 125. STRACHAUER.
- 205f-206w-207s. SURGICAL DIAGNOSIS. In this course the graduate student assists in the practical instruction of the clinical clerks and interns in the University Hospital, and makes a special study of problems in surgical diagnosis. STRACHAUER and others.

- 208f-209w-210s. **SURGICAL SERVICE.** The graduate student acts as house surgeon, and in connection with the service is required to make a special study of the patients, preparing them for clinics and observing them after operations. STRACHAUER and staff.
- 211f-212w-213s. **OPERATIVE SURGERY.** In this course the surgical fellow acts as first assistant at all operations by the surgical staff in University Hospital. When properly qualified, the fellow will be permitted to operate, beginning with simpler surgical procedures. STRACHAUER, LAW.
- 214f,w,s. **ORTHOPEDIC SERVICE.** Three months' service as house surgeon in the State Hospital for Crippled and Deformed Children at Phalen Park. Special facilities for the study of orthopedic diagnosis and treatment. GILLETTE.
- 215f,w,s. **ORTHOPEDIC DIAGNOSIS AND TREATMENT.** History taking, physical examination, treatment, application, and use of plaster of Paris and braces. Graduate student acts as assistant in the clinic. GEIST.
- 216f,w,s. **SURGICAL RESEARCH.** Properly qualified students may undertake original investigation of problems in either experimental or clinical surgery. The work may be used for thesis purposes. STRACHAUER, CORBETT, LAW.
- 217f,w,s. **SURGICAL SEMINAR.** Conferences for reports on surgical literature, with presentation and discussion of specially interesting cases and research work by members of the surgical staff. STRACHAUER.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities for preparation in surgery in the Mayo Foundation are found largely in pathology, surgical diagnosis, and operative surgery. For work in pathology, see the Department of Pathology. For the work in surgical diagnosis, see the Department of Medicine. In the operative service the fellow acts as second assistant every second day for a period of not less than six months. On the alternate days he is charged with the post-operative care of all the patients in the operating room in which he is on service. As soon as the fellow gives evidence that he is competent to do first assisting, usually at some time within his second six months of second assistantship, he is given opportunity to act as first assistant. Selected men of the highest attainments are given opportunity for one additional year of first assisting. In all instances, attempt is made to give the most of the best service to the best men.

Fellows majoring in orthopedic surgery usually take a minor in pathology (see Department of Pathology), one year in orthopedic diagnosis, and one year or more in orthopedic surgery.

Fellows majoring in urology usually take their minor (six months) in pathology, and a half minor (three months) in syphilology (see Course M175, Medicine). Fellows minoring in urology have a diagnostic service of six months in cystoscopy and urethroscopy and three months in the hospital

care of urologic cases. Their diagnostic service consists of twelve months in cystoscopy, proctoscopy, and urethroscopy, and six months in the hospital care of urologic cases. Their surgical work covers nine months in surgery of the abdominal and genito-urinary organs (see Course M153, Surgery).

M151f,w,s,su. LABORATORY DEMONSTRATION of surgical technic. MANN.

M152f,w,s,su. POST-OPERATIVE CARE OF PATIENTS; treatment of complications, surgical and medical. SISTRUNK.

M153f-w,w-s,s-su,f. OPERATIVE SURGERY. Second assistantship in operating rooms; occasional substitute service as first assistant. MAYO, BALFOUR, JUDD, SISTRUNK, PEMBERTON, MASSON, HUNT.

M154f,w,s,su. SURGERY OF THE ABDOMINAL ORGANS AND THE DUCTLESS GLANDS. Operative technic; study of special problems involved. MAYO.

M155f,w,s,su. SURGERY OF THE ABDOMINAL AND GENITO-URINARY ORGANS. Operative technic; study of special problems involved. JUDD.

M156f,w,s,su. SURGERY OF THE GASTRO-INTESTINAL TRACT AND PELVIC ORGANS. Operative technic; study of special surgical problems. BALFOUR.

M157f,w,s,su. SURGERY OF THE THORACIC ORGANS. Operative technic; study of special problems involved. JUDD.

M158f,w,s,su. ORTHOPEDIC DIAGNOSIS TECHNIC. History-taking and physical examination of orthopedic cases. Study of braces, material and construction, measurement and fitting; application and use of plaster of Paris; radiography of orthopedic cases; care of non-surgical orthopedic cases. HENDERSON, MEYERDING.

M159f,w,s,su. ORTHOPEDIC SURGERY. One year of service is offered for those desiring special training in orthopedic surgery. HENDERSON, MEYERDING.

M160f,w,s,su. DEMONSTRATION OF ORTHOPEDIC CASES. Twenty-hour hours. HENDERSON, MEYERDING.

M161f-w,w-s,s-su,su-f. UROLOGIC DIAGNOSIS. Cystoscopic examination and history-taking in diseases of the genito-urinary tract. BRAASCH, CRENSHAW, BUMPUS.

M162f,w,s,su. CYSTOSCOPY, URETHROSCOPY. Cystoscopic examination; pyelography; intravesical operations; fulguration. BRAASCH, CRENSHAW, BUMPUS.

One year or more of service is offered as a part of a three-year fellowship for those desiring to specialize in urology.

M163f,w,s,su. ROENTGEN PLATE-READING. With special reference to cystoscopy (daily). Open to fellows in the department. BRAASCH.

M164f,w,s,su. APPLIED PHYSIOLOGY. Experimental physiology as applied to surgical problems. Open to fellows in surgery, medicine, and pathology. MANN.

M251f,w,s,su. APPLIED PATHOLOGY. Experimental pathology as applied to surgical problems. Open to fellows in pathology, medicine, and surgery. MANN.

M252f,w,s,su. SURGICAL RESEARCH. Investigation of special problems in surgery. Open only to fellows of the department. MANN.

M253f,w,s,su. SURGICAL SEMINAR. Conference for the discussion of original work, problems, and surgical literature. Staff.

M254f,w,s,su. SEMINAR IN ORTHOPEDIC SURGERY. Open to fellows of the department. Twelve hours. HENDERSON.

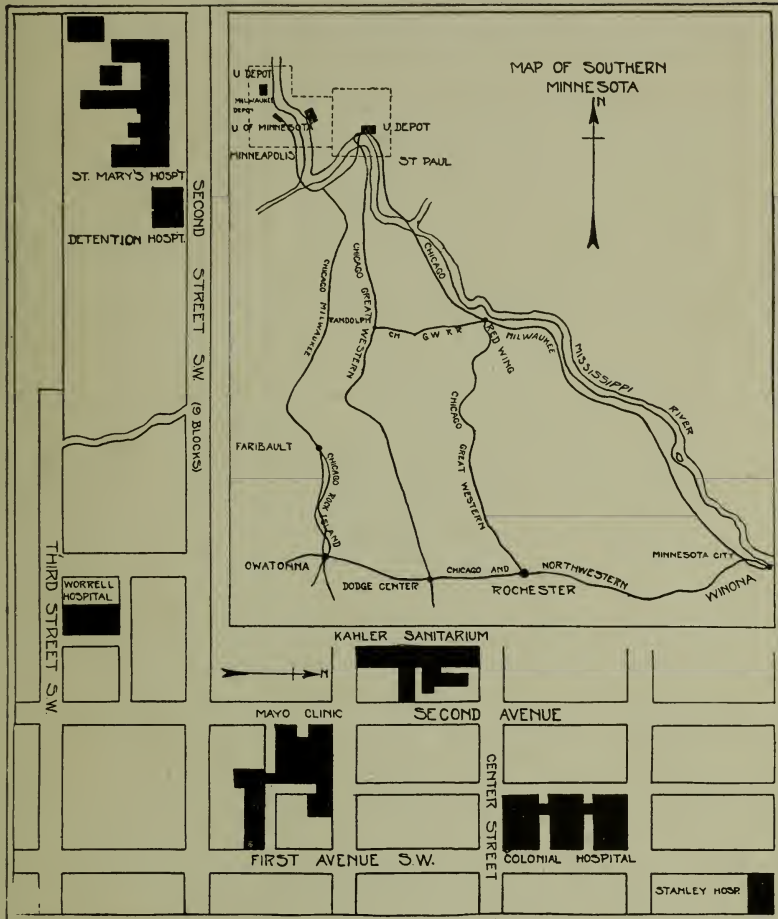
Work is also offered at Rochester in dental surgery under Dr. Boyd S. Gardner.

NOTE: For courses in surgical anatomy, pathology, clinical diagnosis, surgery of the eye, ear, nose, and throat, and roentgen plate-reading, see announcements of corresponding departments.



C.  
M66u2grm

1921/22



Map of a portion of Rochester showing clinics and hospitals serving the Mayo Foundation for teaching purposes

1921							1922													
JULY							JANUARY							JULY						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	1	2	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	..	..	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
3	4	5	6	7	8	9	8	9	10	11	12	13	14	2	3	11	12	13	14	15
10	11	12	13	14	15	16	15	16	17	18	19	20	21	9	10	11	12	13	14	15
17	18	19	20	21	22	23	22	23	24	25	26	27	28	16	17	18	19	20	21	22
24	25	26	27	28	29	30	29	30	31	..	..	..	..	23	24	25	26	27	<b>28</b>	29
31	..	..	..	..	..	..	..	..	..	..	..	..	..	30	31	..	..	..	..	..
AUGUST							FEBRUARY							AUGUST						
..	1	2	3	4	5	6	..	..	..	1	2	3	4	..	..	1	2	3	4	5
7	8	9	10	11	12	13	5	6	7	8	9	10	11	6	7	8	9	10	11	12
14	15	16	17	18	19	20	12	13	14	15	16	17	18	13	14	15	16	17	18	19
21	22	23	24	25	26	27	19	20	21	<b>22</b>	23	24	25	20	21	22	23	24	25	26
28	29	30	31	..	..	..	26	27	28	..	..	..	..	27	28	29	30	31	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SEPTEMBER							MARCH							SEPTEMBER						
..	..	..	..	1	2	3	..	..	..	1	2	3	4	..	..	..	..	..	1	2
4	5	6	7	8	9	10	5	6	7	8	9	10	11	3	4	5	6	7	8	9
11	12	13	14	15	16	17	12	13	14	15	16	17	18	10	11	12	13	14	15	16
18	19	20	21	22	23	24	19	20	21	22	<b>23</b>	<b>24</b>	<b>25</b>	17	18	19	20	21	22	23
25	26	27	<b>28</b>	29	30	..	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	30	31	..	24	25	26	27	28	29	30
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
OCTOBER							APRIL							OCTOBER						
..	..	..	..	..	1	2	..	..	..	..	..	..	1	1	2	3	4	5	6	7
2	3	4	5	6	7	8	2	3	4	5	6	7	8	8	9	10	11	12	13	14
9	10	11	12	13	14	<b>15</b>	9	10	11	12	13	14	15	15	16	17	18	19	20	21
16	17	18	19	20	21	22	16	17	18	19	20	21	22	22	23	24	25	26	27	28
23	24	25	26	27	28	29	23	24	25	26	27	28	29	29	30	31	..	..	..	..
30	31	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
NOVEMBER							MAY							NOVEMBER						
..	..	1	2	3	4	<b>5</b>	..	1	2	3	4	5	6	..	..	1	2	3	4	5
6	7	8	9	10	<b>11</b>	12	7	8	9	10	11	12	13	5	6	7	8	9	10	11
13	14	15	16	17	18	19	14	15	16	17	18	19	20	12	13	14	15	16	17	18
20	21	22	23	<b>24</b>	25	26	21	22	23	24	25	26	27	19	20	21	22	23	24	25
27	28	29	30	..	..	..	28	29	<b>30</b>	31	..	..	..	26	27	28	29	30	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
DECEMBER							JUNE							DECEMBER						
..	4	5	6	7	8	9	..	..	..	1	2	3	4	..	..	..	1	2	3	4
11	12	13	14	15	16	17	4	5	6	7	8	9	10	3	4	5	6	7	8	9
18	19	20	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	11	12	<b>13</b>	14	15	16	17	10	11	12	13	14	15	16
<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	18	19	<b>20</b>	21	22	23	24	17	18	19	20	21	22	23
..	..	..	..	..	..	..	25	26	27	28	29	30	..	24	25	26	27	28	29	30
..	..	..	..	..	..	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..

# CALENDAR FOR THE GRADUATE STUDENTS

1921-1922

1921

September 26 to October 1			Registration of graduate students
			Physical examination for all new students
			Payment of fees
September	28	Wednesday	Fall quarter begins, 8:30 a.m.
October	13	Thursday	Examinations in French and German for candidates for advanced degrees
November	11	Friday	Armistice Day; a holiday
November	19	Saturday	Last day for filing subject-matter of Master's thesis
November	24	Thursday	Thanksgiving Day; a holiday
December	21	Wednesday	Fall quarter ends, Christmas vacation begins, 5:20 p.m.

1922

January	4	Wednesday	Christmas vacation ends, winter quarter begins, 8:30 a.m.
January	12	Thursday	Examinations in French and German for candidates for advanced degrees
February	22	Wednesday	Washington's Birthday; a holiday
March	9	Thursday	Examinations in French and German for candidates for advanced degrees
March	23	Thursday	Winter quarter ends, spring vacation begins, 5:20 p.m.
March	29	Wednesday	Spring vacation ends, spring quarter begins, 8:30 a.m.
May	6	Saturday	Last day for filing theses of candidates for all advanced degrees
May	20	Saturday	Last day for final written examinations for all candidates for advanced degrees
May	30	Tuesday	Memorial Day; a holiday
June	3	Saturday	Last day for oral examinations for all candidates for advanced degrees
June	7	Wednesday	Last day for filing bond for publication of Doctor's thesis: last day for depositing binding fee for Master's thesis
June	11	Sunday	Baccalaureate service
June	13	Tuesday	Spring quarter closes, 5:20 p.m.
June	14	Wednesday	Fiftieth annual commencement

# GRADUATE WORK IN MEDICINE

## ORGANIZATION

The graduate work in medicine in the Medical School and the Mayo Foundation is a part of the work of the Graduate School of the University. Its management is entrusted by the Board of Regents to a committee composed as follows:

The President of the University, LOTUS DELTA COFFMAN, Ph.D.  
The Dean of the Graduate School, GUY STANTON FORD, Ph.D.  
The Dean of the Medical School, ELIAS POTTER LYON, Ph.D., M.D., D.Sc.  
The Director of the Mayo Foundation, LOUIS B. WILSON, M.D.  
JULIUS P. SEDGWICK, M.D., of the Medical School  
CLARENCE MARTIN JACKSON, M.S. M.D., of the Medical School  
JENNINGS C. LITZENBERG, B.S., M.D., of the Medical School  
WILLIAM F. BRAASCH, B.S., M.D., of the Mayo Foundation  
MELVIN S. HENDERSON, M.D., of the Mayo Foundation  
LEONARD G. ROWNTREE, M.D., D.Sc., of the Mayo Foundation

## FACULTY

LOTUS DELTA COFFMAN, Ph.D., President  
GUY STANTON FORD, Ph.D., Dean of the Graduate School  
FRED LYMAN ADAIR, B.S., M.A., M.D., Associate Professor of Obstetrics and Gynecology  
SAMUEL AMBERG, M.D., Associate Professor of Pediatrics (Mayo Foundation)  
DONALD C. BALFOUR, M.B., M.D., Associate Professor of Surgery (Mayo Foundation)  
ROY A. BARLOW, B.S., M.D., Assistant Professor of Rhinology and Otolaryngology (Mayo Foundation)  
MOSES BARRON, B.S., M.D., Assistant Professor of Pathology  
LEE W. BARRY, Ph.D., M.D., Assistant Professor of Obstetrics and Gynecology  
RICHARD O. BEARD, M.D., Associate Professor of Physiology  
ELEXIOUS T. BELL, B.S., M.D., Professor of Pathology  
WILLIAM L. BENEDICT, M.D., Professor of Ophthalmology (Mayo Foundation)  
WALTER M. BOOTHBY, M.A., M.D., Assistant Professor of Medicine (Mayo Foundation)  
WILLIAM F. BRAASCH, B.S., M.D., Professor of Urology (Mayo Foundation)  
ALBERT C. BRODERS, M.D., M.S. in Pathology, Assistant Professor of Pathology (Mayo Foundation)  
EDGAR D. BROWN, Ph.D., M.D., Associate Professor of Pharmacology

- H. CAREY BUMPUS, JR., Ph.B., M.D., M.S. in Urology, Assistant Professor of Urology (Mayo Foundation)
- FRANK E. BURCH, M.D., F.A.C.S., Associate Professor of Ophthalmology and Oto-Laryngology
- RUSSELL D. CARMAN, M.D., Professor of Roentgenology (Mayo Foundation)
- CARL C. CHATTERTON, M.D., Assistant Professor of Orthopedic Surgery
- J. FRANK CORBETT, M.D., F.A.C.S., Associate Professor of Experimental Surgery
- JOHN L. CRENSHAW, M.D., Assistant Professor of Urology (Mayo Foundation)
- GEORGE B. EUSTERMAN, M.D., Associate Professor of Medicine (Mayo Foundation)
- REGINALD FITZ, B.A., M.D., Professor of Medicine (Mayo Foundation)
- BOYD S. GARDNER, D.D.S., Associate Professor of Dental Surgery (Mayo Foundation)
- EMIL S. GEIST, M.D., F.A.C.S., Associate Professor of Orthopedic Surgery
- HERBERT Z. GIFFIN, B.S., M.D., Associate Professor of Medicine (Mayo Foundation)
- \*ARTHUR J. GILLETTE, M.D., F.A.C.S., Professor of Orthopedic Surgery
- DORR F. HALLENBECK, M.D., Assistant Professor of Medicine (Mayo Foundation)
- ARTHUR S. HAMILTON, B.S., M.D., Professor of Mental and Nervous Diseases
- ERNEST M. HAMMES, M.D., Assistant Professor of Mental and Nervous Diseases
- THOMAS B. HARTZELL, D.D.M., M.D., Research Professor of Mouth Infections
- HENRY F. HELMHOLZ, B.S., M.D., Professor of Pediatrics (Mayo Foundation)
- MELVIN S. HENDERSON, M.D., Professor of Orthopedic Surgery (Mayo Foundation)
- ARTHUR T. HENRICI, M.D., Associate Professor of Bacteriology
- ARTHUR D. HIRSCHFELDER, B.S., M.D., Professor of Pharmacology
- EDGAR J. HUENEKENS, B.A., M.D., Assistant Professor of Pediatrics
- VERNE C. HUNT, B.S., M.D., M.S. in Surgery, Assistant Professor of Surgery (Mayo Foundation)
- CLARENCE M. JACKSON, M.S., M.D., Professor of Anatomy
- CONRAD JACOBSON, B.S., M.D., Associate Professor of Surgery
- JOHN B. JOHNSTON, Ph.D., Professor of Comparative Neurology
- EDWARD S. JUDD, M.D., Professor of Surgery (Mayo Foundation)
- NORMAN M. KEITH, B.A., M.D., Assistant Professor of Medicine (Mayo Foundation)
- EDWARD C. KENDALL, Ph.D., Professor of Biochemistry (Mayo Foundation)
- FRANCIS B. KINGSBURY, Ph.D., Associate Professor of Physiologic Chemistry

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\* Deceased.



- WINFORD P. LARSON, M.D., Professor of Bacteriology and Immunology  
ARTHUR A. LAW, M.D., F.A.C.S., Associate Professor of Surgery  
THOMAS G. LEE, B.S., M.D., Professor of Comparative Anatomy  
WILLIS S. LEMON, M.B., Associate Professor of Medicine (Mayo Foundation)
- HAROLD I. LILLIE, B.A., M.D., Professor of Otology, Rhinology, and Laryngology (Mayo Foundation)
- JENNINGS C. LITZENBERG, B.S., M.D., Professor of Obstetrics and Gynecology
- ARCHIBALD H. LOGAN, M.D., Associate Professor of Medicine (Mayo Foundation)
- ELIAS P. LYON, Ph.D., M.D., Professor of Physiology  
JESSE F. MCCLENDON, Ph.D., Professor of Physiology  
WILLIAM C. MCCARTY, M.S., M.D., Professor of Pathology (Mayo Foundation)
- THOMAS BYRD MAGATH, Ph.B., M.S., M.D., Ph.D., Assistant Professor of Clinical Bacteriology and Parasitology (Mayo Foundation)
- ARTHUR T. MANN, B.S., M.D., F.A.C.S., Associate Professor of Surgery  
FRANK C. MANN, M.A., M.D., Professor of Experimental Surgery and Pathology (Mayo Foundation)
- JAMES C. MASSON, M.D., Assistant Professor of Surgery (Mayo Foundation)
- CHARLES H. MAYO, M.A., LL.D., M.D., D.Sc., F.A.C.S., Professor of Surgery (Medical School and Mayo Foundation)
- HENRY W. MEYERDING, M.D., M.S. in Orthopedic Surgery, Assistant Professor of Orthopedic Surgery (Mayo Foundation)
- ALEXANDER B. MOORE, M.D., Associate Professor of Roentgenology (Mayo Foundation)
- WILLIAM R. MURRAY, Ph.B., M.D., F.A.C.S., Professor of Ophthalmology and Oto-Laryngology
- ROBERT D. MUSSEY, M.D., Associate Professor of Medicine (Mayo Foundation)
- GORDON B. NEW, D.D.S., M.D., Professor of Rhinology, Laryngology, and Stomatology (Mayo Foundation)
- HORACE NEWHART, B.A., M.D., F.A.C.S., Assistant Professor of Oto-Laryngology
- JOHN DE J. PEMBERTON, B.A., M.D., M.S. in Surgery, Assistant Professor of Surgery (Mayo Foundation)
- CHAUNCEY J. V. PETTIBONE, Ph.D., Associate Professor of Physiologic Chemistry
- HENRY S. PLUMMER, M.D., Professor of Medicine (Mayo Foundation)  
WILLIAM A. PLUMMER, M.D., Assistant Professor of Medicine (Mayo Foundation)
- WALTER R. RAMSEY, M.D., Associate Professor of Pediatrics  
ANDREW T. RASMUSSEN, Ph.D., Associate Professor of Neurology  
HARRY B. RICHARDS, Associate Professor of Surgery  
HARRY P. RITCHIE, Ph.B., M.D., F.A.C.S., Associate Professor of Surgery

- HAROLD E. ROBERTSON, B.A., M.D., D.Sc., Professor of Pathology (Mayo Foundation)
- FREDERICK C. RODDA, M.D., Associate Professor of Pediatrics
- EDWARD C. ROSENOW, M.D., Professor of Experimental Bacteriology (Mayo Foundation)
- LEONARD G. ROWNTREE, M.D., D.Sc., Professor of Medicine (Mayo Foundation)
- ARTHUR H. SANFORD, M.A., M.D., Associate Professor of Clinical Bacteriology and Parasitology (Mayo Foundation)
- RICHARD E. SCAMMON, Ph.D., Professor of Anatomy
- JOHN P. SCHNEIDER, M.D., Associate Professor of Medicine
- FREDERICK H. SCOTT, Ph.D., M.B., D.Sc., Professor of Physiology
- JULIUS P. SEDGWICK, B.S., M.D., Professor of Pediatrics
- MAX SEHAM, M.D., Assistant Professor of Pediatrics
- WALTER D. SHELDEN, B.S., M.D., Professor of Neurology (Mayo Foundation)
- WALTER E. SISTRUNK, Phm.G., M.D., Associate Professor of Surgery (Mayo Foundation)
- LEDA J. STACY, M.D., Assistant Professor of Medicine (Mayo Foundation)
- JOHN H. STOKES, B.A., M.D., Professor of Dermatology (Mayo Foundation)
- ARTHUR C. STRACHAUER, M.D., F.A.C.S., Professor of Surgery
- JOHN SUNDWALL, M.D., Ph.D., Professor of Hygiene
- ROOD TAYLOR, M.D., Ph.D. in Pediatrics, Assistant Professor of Pediatrics
- GILBERT J. THOMAS, M.D., Assistant Professor of Surgery
- HENRY L. ULRICH, B.S., M.D., Associate Professor of Medicine
- S. MARX WHITE, B.S., M.D., Professor of Medicine
- RUSSELL M. WILDER, B.S., M.D., Ph.D., Assistant Professor of Medicine (Mayo Foundation)
- LOUIS B. WILSON, M.D., Professor of Pathology (Mayo Foundation)
- HENRY W. WOLTMANN, B.S., M.D., Ph.D. in Neurology, Assistant Professor of Neurology (Mayo Foundation)
- FRANKLIN R. WRIGHT, D.D.S., M.D., F.A.C.S., Associate Professor of Urology
- ANNE BENTON, M.A., Instructor in Bacteriology
- DAVID M. BERKMAN, M.D., M.S. in Medicine, Instructor in Medicine (Mayo Foundation)
- MAURICE B. BONTA, B.A., B.S., M.D., Instructor in Medicine (Mayo Foundation)
- HARRY M. CONNER, M.D., Instructor in Medicine (Mayo Foundation)
- FRED W. GAARDE, B.S., M.D., Instructor in Medicine (Mayo Foundation)
- CHARLES C. GAULT, B.A., Instructor in Physiology
- STUART W. HARRINGTON, M.D., M.S. in Surgery, Instructor in Surgery (Mayo Foundation)
- HOWARD R. HARTMAN, B.S., M.D., Instructor in Medicine (Mayo Foundation)

- CARL A. HEDBLÖM, M.D., M.A., Ph.D. in Surgery, Instructor in Surgery (Mayo Foundation)
- HORACE R. LYONS, M.D., M.S. in Oto-Laryngology, Instructor in Rhinology and Oto-Laryngology (Mayo Foundation)
- NABOTH O. PEARCE, M.D., M.S., Instructor in Pediatrics
- LEE W. POLLOCK, B.S., M.D., Instructor in Medicine (Mayo Foundation)
- AVERY D. PRANGEN, B.S., M.D., Instructor in Ophthalmology (Mayo Foundation)
- IRENE SANDIFORD, B.A., Ph.D., Instructor in Physiologic Chemistry (Mayo Foundation)
- HOWARD O. STEARNS, M.S., Instructor in Roentgenology and Radiology (Mayo Foundation)
- CHARLES G. SUTHERLAND, M.B., Instructor in Roentgenology (Mayo Foundation)
- FREDERICK A. WILLIUS, M.D., M.S. in Medicine, Instructor in Medicine (Mayo Foundation)

## GENERAL INFORMATION

The graduate work in medicine here outlined is not intended for those seeking brief practitioners' or review courses. Opportunities of this kind are to be found in the bulletin of the Medical School.

### HISTORY

In the fall of 1914, the University of Minnesota began graduate work in various fields of medicine and surgery in addition to that already offered for some time in the laboratory branches. The conditions laid down for this work as regards admission, residence, thesis, and examinations were those already applied by the Graduate School in approving all candidates for graduate degrees.

The training of medical graduates for special work in pathology, clinical medicine, and surgery by means of internships, residencies, and assistantships had been developed in the Mayo Clinic at Rochester, until in 1912 definite three-year services in these subjects for graduates in medicine, who had previously had one year's internship in a general hospital, were provided. These services were designated "fellowships," a term intended to cover internships, assistantships, residencies, etc. In order to perfect the organization and place the work on a permanent basis, February 9, 1915, a corporation, the Mayo Foundation for Medical Education and Research, was founded by William J. and Charles H. Mayo. On June 9, 1915, the University of Minnesota and the Mayo Foundation for Medical Education and Research entered into an agreement, by the terms of which the funds and income of the Mayo Foundation for Medical Education and Research are devoted, under the direction of the regents of the University of Minnesota, to the promotion of graduate work in medicine and to research in this field. On September 13, 1917, the funds and income of the Mayo Foundation were transferred entirely to the regents of the University.

### PURPOSE

In an age of specialization with the development of graduate work in all fields and phases of the sciences, letters, and arts, such educational work needs no elaborate justification. In a subject like medicine, intimately connected with established fields of research such as biology, chemistry, anatomy, physiology, pathology, and bacteriology the need for scientific research and for the training of scientific specialists, investigators, and teachers is as great as in any subject, and of as vital importance.

The possibilities of such work hitherto have suffered less from neglect than they have from the lack of organization, standardization, and certification by the educational institutions which have found it possible and advisable to put such applied subjects as agriculture, education, engineering, and commerce upon a scientific basis, and have freely recognized the accomplishments of trained students by the granting of higher earned degrees

in these fields. In medicine in the United States, the leading specialists in practice and the trained productive investigators have usually been developed by long years in internships, minor teaching positions, hospital residencies, or personal apprenticeships to other specialists. A few have obtained their special training in general practice, gradually narrowing to a particular field. Many men in both groups have broadened themselves by visits to other laboratories and clinics for observation and by longer or shorter periods of foreign study. A much larger body of clinical specialists of varying attainments have been developed by so-called post-graduate or polyclinic medical courses or by the simple and convenient method of self-proclamation.

Taken as a whole, by such undirected processes graduate students are apt to waste time on unessentials and to acquire very inadequate knowledge of many of the essentials. In clinical branches such processes fail to provide any sure protection to the public against the untrained specialist or to open any avenue to the public's confidence for the properly trained specialist. And medical education, if it is to advance, must at least be able to supplement a faculty of skilled practitioners with men trained to carry forward the frontiers of medical science.

The objects of this graduate work in medicine are accordingly the training for medical practice of fully equipped and properly certified specialists and of investigators and teachers of medicine.

#### STANDARDS

In beginning its experiment in graduate work in medicine the University of Minnesota, in order to secure results and safeguard scientific standards, adopted those general policies and methods already indicated by the established graduate work in other sciences. The development has depended upon the maintenance of real standards of admission, the supply of qualified advisers to graduate students, the provision of adequate laboratory, clinical, and library equipment, and the institution of rigid tests in course and examinations in residence, with evidence of the power of productive research on the part of the student as evidenced in a thesis.

In doing this work the University of Minnesota is not seeking to multiply the opportunities for securing simply technical training through practitioners' courses. The graduate work is definitely intended to provide opportunities in three years of work for the well-prepared serious-minded student to fit himself in the science, as well as in the art of some special field of medicine or surgery. Entrance upon the work and continuance in it, as well as the holding of scholarships or fellowships in the Medical School or on the Mayo Foundation, will be strictly conditioned upon evidences of power and growth along scientific lines. The value of technical or mechanical skill as a practitioner or operator has its place, but will be subordinated to and measured by the power and product of the brain that guides the hand. From the standpoint of both the University and the prospective student it is highly important that this distinction in purpose be kept clearly in mind.



By the present arrangement of courses in arts, science, and medicine a properly prepared student may enter the University, and in seven years secure the usual doctorate degree in arts, in science, or in medicine. The object of the plan pursued at this University since 1914 is to provide three years of additional work on the basis of the degree of Doctor of Medicine, and leading to the special degree of Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in Medicine, in Surgery, in Pathology, etc.

In clinical branches the degree of Master of Science is intended primarily to indicate scientific proficiency. To be recommended for this degree the candidate must have given evidence by two or three years of residence that he is competent to begin the practice of a clinical specialty in a scientific manner without the supervision of others. The Doctorate of Philosophy in clinical subjects will be given only to those men who have given evidence not only of proficiency at least equal to that required for the Master's degree, but who in addition present evidence of well-marked ability to advance medical science.

#### LABORATORY EQUIPMENT

The laboratory equipment for the prosecution of graduate work in medicine is located in Minneapolis, St. Paul, and Rochester.

The laboratory branches are well housed in excellently equipped buildings on the campus at Minneapolis and at Rochester. Anatomy, chemistry, pathology, and bacteriology are in modern University buildings especially designed for them. Physiology, physiologic chemistry, and pharmacology are located in Millard Hall, a modern building of the best type. The laboratories for experimental medicine and surgery and extensive animal quarters are also in this building. The University museums of anatomy, pathology, and surgery contain a large number of specimens available for teaching purposes.

In Rochester, the laboratories of general pathology, pathologic anatomy, clinical pathology and bacteriology, experimental bacteriology, physiologic chemistry, experimental pathology and physiology, electrocardiography, roentgenology, photography are in the Mayo Clinic Building, as is also the pathologic working museum, which contains over 125,000 specimens.

Laboratories of surgical pathology are at St. Mary's, Colonial, Worrell, and Kahler hospitals. The metabolic laboratory is at the Kahler Hospital. A laboratory of physiologic chemistry is at the Olmsted Hospital. A farm for experimental animals is maintained outside the city.

#### CLINICAL EQUIPMENT

The University owns and controls Elliot Memorial Hospital with its service building. This provides a clinic of 200 beds, and has the accumulated hospital records of ten years. The Out-Patient Department of the hospital is housed in Millard Hall and received 15,696 new patients and 65,518 patients' visits during the year ending June 30, 1920.

The State Hospital for the Crippled and Deformed at Phalen Park, St. Paul, offers the University full participation in its clinical opportunities.

The city hospitals of Minneapolis and the City and County Hospital of St. Paul, representing in all some 1,400 beds, exhibit every phase of clinical service in their wards and amphitheatres. This material is available for graduate work.

In Rochester, St. Mary's, Colonial, Worrell, Stanley, Curie, Olmsted, Alfred, and Kahler hospitals and the Damon Sanitarium have an aggregate of about 1,300 beds with twelve operating rooms for general surgery and six for diseases of the organs of the special senses. With the completion of buildings now under construction, the number of beds will be increased by 450. All patients are examined clinically in the Mayo Clinic Building and its annexes. In 1920, 59,745 patients were examined. In addition more than 400,000 clinical histories are on file and available for investigative studies. During 1920, 22,567 operations were performed.

Consent for post-mortems is obtained with about 85 per cent of patients dying in the clinic.

The working museum contains more than 125,000 pathologic specimens. All case histories and specimens are classified and arranged so as to be readily available for scientific research.

Arrangements have been made whereby fellows or other graduate students in medicine may divide their time, part of their work being taken in the Mayo Foundation at Rochester, and part in the Medical School at Minneapolis and St. Paul.

#### LIBRARIES

Besides the University Library and the departmental libraries, there are at the disposal of the student the general medical libraries in Millard Hall and the Mayo Clinic Building, and the collections of the Hennepin County and Ramsey County Medical Societies. Current issues and complete files of most important medical periodicals are available either in Minneapolis or Rochester.

#### METHODS OF STUDY

Every attempt is being made to establish the graduate work in medicine on a true University basis. Little class work is done. No short cramming courses are offered. The Mayo Foundation lectures at Rochester and frequent special lectures at the Medical School, are given by men who are enthusiastically interested in their particular topics, but each lecturer presumes that his hearers are already well grounded in the fundamentals of his subject. Attendance at these lectures is purely optional with the graduate student. No quizzes are held and no examinations are given on these lectures. The same is true of the clinical and laboratory demonstrations and departmental seminars. Everything is done to impress the graduate student that his residence is an opportunity for him to find out things for himself and not a period in which he will be instructed by undergraduate methods. The student's work is carefully graded by his immediate chief, whose duty it is to determine the student's ability by daily intercourse with a smaller number of students rather than by class quizzes and formal examinations. Students holding fellowships who do not evince strong per-

sonal initiative will not be recommended for annual reappointment, or may be asked to resign their fellowships before the end of their period of appointment. In the arrangement of work the best opportunities will be consistently given to the best qualified men. Low-grade and mediocre men will not be permitted to continue to fill appointments to the exclusion of high-grade men. Work which receives a grade below B will not be counted for graduate credit.

#### REGISTRATION AND NUMBER OF STUDENTS

All students entering upon graduate work in medicine will register with the dean of the Graduate School. Students who begin their residence work in Rochester may fulfill the preliminary requirements by registering there with the director of the Mayo Foundation.

The number of graduate students who will be registered for work is determined by the clinical opportunities. This limitation applies to those doing their major work in clinical medicine and surgery and not to those majoring in the laboratory departments.

#### TUITION

The tuition fee for the graduate work in clinical medicine and surgery is \$30 per quarter. For students in the fundamental laboratory branches, the tuition fee is \$10 per quarter. Extra fees may be charged to cover the cost of materials and supplies for exceptional laboratory experimentation. The fees for graduate work in the summer session are stated in the special summer session bulletin. Fellows, scholars, and members of the teaching or scientific staff are exempt from tuition and fees.

#### FELLOWSHIPS AND SCHOLARSHIPS

Teaching fellowships in the medical school are now established as follows: in surgery, 2; in internal medicine, 2; in obstetrics, 2; in ophthalmology and oto-laryngology, 2; in mental and nervous diseases, 2; and in pediatrics, 3. Three fellowships are also available in the University Health Service. They carry a stipend of \$600 the first year, \$750 the second, and \$1,000 the third. These teaching fellows are required to devote their entire time (excepting an annual vacation of three weeks) to graduate work, including a small amount of teaching.

Similar teaching fellowships have been established in the fundamental laboratory department of the Medical School as follows: in anatomy (including histology and embryology), 3; in physiology and physiologic chemistry, 1; in pathology, 1; in pharmacology, 1. These fellowships carry a stipend of \$900 the first year, \$1,200 the second, and \$1,500 the third year. They require a small amount of teaching, the remainder of the time being devoted to graduate work leading to advanced degrees.

In addition, there are at Minneapolis 5 scholarships, without stipend, carrying free tuition with opportunity for graduate study in any of the clinical departments.

The attention of prospective medical graduate students is also called to the Shevlin Fellowship in medicine yielding \$500 and tuition. Applications should be in the hands of the dean of the Graduate School before March 1.

The Mayo Foundation carries the following fellowships: in clinical and experimental surgery 63; in orthopedic surgery, 5; in ophthalmology, 4; in rhinology and oto-laryngology, 8; in dental surgery, 4; in clinical and experimental medicine, 45; in neurology, 2; in dermatology, 4; in urology, 6; in roentgenology, 4; in pathology, 4; in bacteriology, 2; in chemistry, 2. The fellowships in clinical branches pay \$600 the first year, \$750 the second year, and \$1,000 the third year. The fellowships in pre-clinical branches pay \$900 the first year, \$1,200 the second year, and \$1,500 the third year. They require full time with an annual vacation of two weeks.

Nominations for fellowships on the Mayo Foundation are made each quarter, beginning with July 1, for residence to begin six months later or as vacancies occur. In the Medical School appointments are made as vacancies occur.

The Miller Hospital Clinic, St. Paul, supports four clinical fellowships, one each in surgery, medicine, ophthalmology, and oto-laryngology, and obstetrics and gynecology. Appointments are made as vacancies occur. Apply through the Graduate School.

All appointments are made for one year and are renewable annually for a period of three years upon the basis of satisfactory progress in the work pursued. Requests for blanks for application for fellowships and scholarships should be addressed to the dean of the Graduate School, University of Minnesota, Minneapolis, Minnesota, or to the director of the Mayo Foundation, Rochester, Minnesota.

#### ASSISTANTSHIPS

A few qualified assistants, such as travelling fellows from other universities, officers of the medical corps of the United States Army, Navy, or Public Health Service, et al., designated as special students and not candidates for degrees may be accepted at Rochester in laboratory and clinical branches for short periods. The number is necessarily limited in order not to interfere with the work of the resident fellows. Correspondence concerning this work should be directed to the director of the Mayo Foundation, Rochester, Minnesota.

Several of the departments in the Medical School (including anatomy, physiology, and pathology) have paid assistantships which may furnish means of self-support while the holder is pursuing graduate work. For further information, address the dean of the Medical School.

#### CLINICAL AND CLASS WORK FOR VISITING OR RESIDENT PRACTITIONERS

In order that there may be no misunderstanding, it should be stated that the graduate work for a limited number described above in no way changes or modifies the opportunities for observation hitherto extended



visiting physicians and surgeons by the Mayo Clinic in Rochester, or the arrangements offered in Minneapolis by the Medical School for practitioners who wish to attend such undergraduate medical classes as may be of profit to them without interfering with the regular work of the staff and students of the Medical School. Inquiries concerning these opportunities should be addressed to the dean of the Medical School, Millard Hall, Minneapolis, Minnesota.

#### SUMMARY OF REQUIREMENTS

The various steps involved in the requirements for the degree of Doctor of Philosophy (Ph.D.) in any one of the clinical or laboratory departments are briefly summarized on pages 21 and 22. The requirements for the Master's degree (M.A. or M.S.) are also indicated. Further information concerning graduate work in general may be found in the general Graduate School bulletin.

#### REQUIREMENTS FOR ADVANCED DEGREES IN MEDICINE

1. *Selection.*—In the selection of graduate medical students, and in making appointments to fellowships for medical graduate work, preference will be given, other things being equal, to students who have done more than the usual amount of undergraduate medical work in the fundamental medical sciences (i.e., anatomy, physiology, pathology, etc.) through which they should make their approach to the specialty which they wish to take as a major subject.

2. *Admission.*—All graduate students are admitted by the dean of the Graduate School. Entrance upon work for the advanced degrees of Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in the clinical departments of medicine is limited to those who have: (a) the Bachelor's degree in arts or science, or its equivalent;\* (b) the degree of Doctor of Medicine from acceptable institutions (i.e., those in Class A of the American Medical Association); and (c) one year's experience as an intern in an approved hospital or as an assistant in a laboratory in an acceptable medical school. In the fundamental laboratory sciences (anatomy, physiology, bacteriology, pathology, and pharmacology) properly prepared students may be admitted without (b) and (c) as candidates for the Master's degree (M.A. or M.S.) or the Doctor's degree (Ph.D.).

Upon entrance to the Graduate School, the candidate, with the approval of the dean, will select his adviser in the field of his major work. With the approval of his adviser and the dean, he will outline a study program for the year, and if possible for the period of residence.

The study program for the second and third years is subject also to the approval of the Medical Group Committee.

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\* Students who have completed at least two years of pre-medical collegiate work, making an equivalent of the seven years combined Arts-Medicine Course at the University of Minnesota, are eligible for admission as graduate students.



3. *Residence*.—For the Doctor's degree (Ph.D.) at least three full years of successful graduate study are required, including certain special requirements noted below. For the Master's degree (M.S.) in clinical subjects, two or three years are required. For the Master's degree in the laboratory sciences a minimum of one year of residence is required.

4. *Language requirements*.—A reading knowledge of French and German in the field of the candidate's major must be certified by the professors in charge of these languages at least one year before the Doctor's degree is conferred, and before admission to the preliminary examination. The candidate's adviser or his representative is expected to attend this examination and to furnish appropriate literature for the test. For the Master's degree in the laboratory sciences, a reading knowledge of one foreign language is also required, which must be certified before the end of the second quarter. For the Master's degree (M.S.) in the clinical branches, the language certificate is optional.

5. *Minor*.—With the approval of his adviser and the dean of the Graduate School, each student upon entrance selects a minor, which must be logically related to his major subject, and (for the Doctor's degree) must be completed by the end of the second year. The minor is preferably a laboratory subject in some other department, and should amount to not less than one sixth of the total work for the degree. At least one sixth of the work offered for the degree in a clinical subject should consist of graduate work in the fundamental laboratory branches, which will serve as a basis for the proposed clinical specialization. This fundamental work should be concentrated in the first part of the course so far as possible. The final examination in the minor for the Doctor's degree is included in the preliminary examination, as noted below. For the Master's degree no special examination is required in the minor, aside from the usual course examinations.

6. *Major*.—The major is that department in which the student desires to specialize. Together with the thesis, it should occupy at least two thirds of the total work for the degree. At least one year before attaining the Doctor's degree, the following procedure is required in order that the candidate may become eligible for the preliminary examination. In addition to the completion of the minor work and of the language requirement, he must have the written approval of the department committee (which includes the graduate faculty members) of the major subject. The statement of the department committee should include the subject of the special problem for the thesis, and should certify as to the ability of the candidate to meet all requirements for the degree sought. It should be based on the quality of the candidate's daily work in residence.

7. *Admission to candidacy*.—For the Master's degree, students who have met the language requirements, whose daily work in residence as indicated by quarterly grades, has been satisfactory and whose thesis subject has been properly approved, are admitted to candidacy at the end of

the second quarter by vote of the Executive Committee of the Graduate School. For the Doctor's degree, the student is required to pass a preliminary examination, as noted below, before admission to candidacy.

8. *Preliminary examination.*—At least one calendar year before the Doctor's degree is conferred, a preliminary examination of the student shall be given by a committee appointed by the dean and including the student's adviser as chairman, a representative of the Medical Graduate Committee (other than the adviser), the head of his major department, a representative of the minor, and such additional members as the dean may consider necessary. Certificates of proficiency in French and German, completion of the minor work and the recommendation of the major department shall be required before admission to this examination. The examination is in addition to the usual course examinations. It shall cover the graduate work previously taken by the student, *and may include any work fundamental thereto.* The examination may be either written or oral, or both, as determined by the examining committee. Only after the successful completion of this examination may the student be enrolled as a candidate for the Doctor's degree. Students failing to pass this preliminary examination shall not be reexamined until at least one quarter has passed.

9. *Thesis.*—Each candidate for an advanced degree (Master's or Doctor's) must submit a thesis. For the Master's degree, the subject of the thesis should be filed with the dean of the Graduate School by November 15. The subject must be approved by the adviser and by the Medical Graduate Committee. The topic should be within the field of the major, and the thesis should represent approximately half of a year's work of the student. The thesis must be written in acceptable English. It must show ability to work independently, give evidence of power of independent thought both in perceiving problems and in making satisfactory progress toward their solution. Familiarity with the bibliography of the special field and correct citation of authorities are expected.

The Master's thesis must be typewritten in triplicate, one copy on a special form of linen stock, the other two as carbon copies. Samples of the paper required should be examined in the dean's office. The three copies of the thesis must be filed in the dean's office not later than six weeks before graduation. The thesis will be examined by a committee appointed by the dean, on recommendation of the Medical Graduate Committee. Unanimous approval by the thesis committee is necessary for the acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the registrar, at least one week before commencement, the sum of one dollar for binding one copy of the thesis, which will be cataloged and deposited in the University Library.

For the Doctor's degree, a more elaborate thesis is required. The subject is to be stated in the written department recommendation, which precedes the preliminary examination at the end of the second year. The accumulation of material for the thesis should be started much earlier. The thesis must give evidence of originality and power of independent

investigation. It must embody results of research forming a real contribution to knowledge and must exhibit a mastery of the literature of the subject and a familiarity with the sources of knowledge. The matter must be presented with a fair degree of literary skill.

The thesis must be typewritten in triplicate, to facilitate reading by the thesis committee. No special size or form is required for the Doctor's thesis, since it is to be printed subsequently. The three copies must be filed in the dean's office not later than six weeks before graduation. The dean will appoint a thesis committee with the student's adviser as chairman. Unanimous approval by this committee will be necessary for the acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the registrar, not later than one week before commencement, a sufficient bond or such sum of money as will be required to print 100 copies of the thesis for the use of the University and as many additional copies as the candidate may require for himself. If the thesis is to be published elsewhere, reprints will be acceptable, if bound with covers in the special form required by the University.

10. *Final written examination.*—In addition to the usual course examinations in all subjects where such are given, the candidate for the Master's degree must pass a final written examination in the field of the major. (No *special* final examination is required in the minor.) The *final written examination* will be held not later than four weeks before commencement. It is given by the members of the graduate faculty in the major department, the adviser acting as chairman. This examination shall cover all the work done in the major, and may include any work fundamental thereto.

For the Doctor's degree, a final written examination in the major subject is similarly given, after the thesis is presented and at least four weeks before commencement.

11. *Final oral examination.*—If all other requirements for the degree have been met, including the final written examination and the acceptance of the thesis, the final oral examination will be held not less than two weeks before commencement.

For the Master's degree, the adviser will act as chairman of the examining committee, which will include all the instructors with whom the student has taken work, the thesis committee, and ex-officio, the head or chairman of the department in which the major work is done. Any member of the graduate faculty may attend as a visitor, and written notice shall be sent by the chairman of the committee to all members of the graduate faculty in the major and minor departments. The final oral examination will cover all the work offered for the degree, and may include other work fundamental thereto. All final examinations for the higher degrees in medicine will include questions on the history of medicine with special reference to the candidate's major field. At the close of the examination, the committee will vote upon the candidate, taking into account all of his work. A majority vote is required for approval.

For the Doctor's degree, the committee conducting the final oral examination will consist of the adviser as chairman, of a majority of the members of the graduate faculty in the major department, and of at least three other members of the graduate faculty appointed by the dean. At least one member of this committee shall be from a group other than the one in which the major department is included. This examination is to cover the field of knowledge represented by the major work, and shall not exceed three hours. The date of the final oral examination for the doctorate shall be publicly announced, and the examination shall be open to any member of the graduate faculty. Upon completion of the examination, a formal vote of the committee shall be taken and an affirmative vote of at least two thirds of the members shall be necessary for recommendation of the candidate for the degree.

12. *Recommendation by the faculty.*—The dean will report to the graduate faculty the names of those who have completed the requirements for the Master's and Doctor's degrees, and those duly approved will be recommended by the faculty to the Board of Regents of the University. Unless excused by the dean of the Graduate School and the president of the University, all candidates are required to be present at commencement when the degrees are conferred.

#### TABULAR SUMMARY OF REQUIREMENTS FOR THE MASTER'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
Program, major and minor	Adviser and dean of the Graduate School.	On entrance.
Approval of thesis subject	Adviser and group committee...	November 15.
Language requirement...	Adviser and language department	Before close of second quarter.
Approval of candidacy...	Executive Committee.....	Beginning of third quarter.
Filing of thesis.....	Dean of the Graduate School....	Six weeks before graduation.
Examination of thesis...	Thesis committee.....	Before admission to final oral examination.
Final written examination in major.....	Major department members of the graduate faculty.....	Not later than four weeks before commencement and before final oral.
Final oral examination on all work.....	Thesis committee; all instructors; head of major department.....	Not later than two weeks before commencement.
(Course examinations as required at the usual time.)		
Fee for binding thesis..	Registrar .....	One week before commencement.

(For the Master's degree in clinical subjects, the dates refer to the last year.)

TABULAR SUMMARY OF REQUIREMENTS  
FOR THE DOCTOR'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
<b>FIRST YEAR</b>		
Major .....	Adviser and dean of Graduate	
Minor .....	School .....	
<b>SECOND YEAR</b>		
Tentative program of entire second and third years' work...	Adviser, Medical Graduate Committee, and dean of Graduate School .....	Before beginning work of second year.
Major, including thesis	As for tentative program.....	
Minor .....	Adviser and minor department...	Before admission to preliminary examination.
Language .....	Adviser and language department.	
Recommendation ....	By major department.....	One calendar year before degree is to be conferred.
Preliminary examination .....	Special committee.....	
<b>THIRD YEAR</b>		
Major, including thesis	Adviser, Medical Graduate Committee, and dean of Graduate School .....	
Filing of thesis.....	Dean .....	Six weeks before graduation.
Approval of thesis....	Thesis committee.....	Before admission to final oral examination.
Final written examination in major.....	Major department members of the graduate faculty .....	Four weeks before commencement and before final oral examination.
Final oral examination	Adviser, majority of members of major department, and other members appointed by dean of Graduate School.....	Not later than two weeks before commencement.
Bond for publication of thesis .....	Registrar .....	Not later than one week before commencement.



## DEPARTMENTAL STATEMENTS

The members of the faculty at Rochester (Mayo Foundation) are indicated by an asterisk (\*) in the list at the head of each departmental statement. The courses given at Rochester are grouped separately, and the numbers given the special prefix "M." The suffixed f, w, s, and su indicate fall, winter, spring, and summer quarters, respectively. The hyphen indicates courses continuous through the quarters indicated. Suffixed letters separated by commas indicate the repetition of the course in the corresponding quarters. The courses numbered between 100 and 200 are less advanced in character, and in some cases are open as electives to properly qualified undergraduates. The courses above 200 are primarily graduate in character, of the more advanced or research type.

The various divisions are grouped under the following departments:

1. Anatomy (including histology and embryology)
2. Bacteriology and Immunology
3. Medicine. (including general medicine, dermatology, and mental and nervous diseases)
4. Obstetrics and Gynecology
5. Ophthalmology and Oto-Laryngology
6. Pathology
7. Pediatrics
8. Pharmacology and Therapeutics
9. Physiology and Physiologic Chemistry
10. Roentgenology
11. Surgery (including general surgery, experimental surgery, orthopedic surgery, urology, and dental surgery)

### ANATOMY

Professors CLARENCE M. JACKSON, JOHN B. JOHNSTON, THOMAS G. LEE, RICHARD E. SCAMMON; Associate Professor ANDREW T. RASMUSSEN.

The Institute of Anatomy offers excellent facilities to students who wish to take advanced work or to pursue investigations in anatomy.

The prerequisite work for all students who desire a major or minor in the Department of Anatomy includes general zoology (animal biology), 6 semester hours, and advanced zoology or elementary courses in anatomy (including histology, embryology, and neurology), 6 semester hours. In addition, each student who desires a major in anatomy must have had the elementary courses in that branch of anatomy in which he desires to specialize—gross anatomy, histology, embryology, or neurology. Students majoring in clinical subjects who desire a minor in anatomy must have had the courses in anatomy usually required of medical students (including Courses 103, 107, and 111). A reading knowledge of either French or German is required of students who desire a major in anatomy for the Master's degree, and a reading knowledge of both French and German is required of those who are candidates for the Doctor's degree.

## COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

- 103s,su. HUMAN HISTOLOGY. A microscopic study of the various tissues and organs. Prerequisites: Anatomy 5-6, or equivalent. Nine credits. MR. SCAMMON.
- 107s,su. HUMAN EMBRYOLOGY. The development of the human body. Prerequisites: Anatomy 5-6, or equivalent. Six credits. MR. SCAMMON.
- 111f,su. HUMAN NEUROLOGY. A study of the gross and microscopic structure of the central nervous system and sense organs of man. Prerequisites: Anatomy 103 and 107, or Animal Biology 9-10. Six credits. MR. RASMUSSEN.
- 112f,w,s. COMPARATIVE NEUROLOGY OF VERTEBRATES. Prerequisites: Anatomy 111, or Animal Biology 27. MR. JOHNSTON.
- 121f,s. ANATOMICAL TECHNIC. Lectures and laboratory work upon the principles and practice of microtechnic. Prerequisites: Anatomy 103, or Animal Biology 9-10. Three credits. DR. LEE.
- 129f-130w-131s. TOPOGRAPHIC ANATOMY. Based upon a study of cross-sections of the human body. Lectures and laboratory work. Prerequisites: Anatomy 5-6-7. Two credits (or more) each quarter. DR. JACKSON.
- 133f,su. ANATOMY OF THE FETUS AND CHILD. A survey of prenatal and postnatal development. Fourth-, fifth-, or sixth-year medical, or graduate students. Limited to sixteen students. Prerequisites: Courses 5-6-7, 107. 4 credits. MR. SCAMMON.
- 134w,s. ANATOMY OF THE NEW-BORN. A detailed laboratory study of the anatomy of the new-born. Fourth-, fifth-, or sixth-year medical, or graduate students. Prerequisites: Course 133, or equivalent. 3 credits. MR. SCAMMON.
- 135f,su. PHYSICAL DEVELOPMENT OF CHILDHOOD. Lectures, with study of illustrative material. Primarily for students in the College of Education; open to medical or graduate students by permission of instructor. 2 credits. MR. SCAMMON.
- 137f-138w-139s-140su. IMPLANTATION AND PLACENTATION. A study of the implantation of the ovum, the formation of the placenta, and the earliest stages of development in man and mammals. Prerequisites: Anatomy 102 or equivalent. Three credits (or less). DR. LEE.
- 149w. EXPERIMENTAL NEUROLOGY. A study of the morphology of the central nervous system by experimental methods. Prerequisites: Course 111. Three credits (or more). MR. RASMUSSEN.
- 153f-154w-155s-156su. ADVANCED ANATOMY. Individual topics for advanced work in gross anatomy, histology, embryology, or neurology will be assigned to students who have completed the elementary courses in

the corresponding subjects. Special courses are arranged for clinical graduate students. DR. JACKSON, MR. JOHNSTON, DR. LEE, MR. SCAMMON, MR. RASMUSSEN.

160f-162w-163su. SEMINAR IN GROWTH OF CHILDREN. A study with graphic analysis of data on physical development of children of school age. Prerequisites: Course 135, or equivalent. Hours and credits to be arranged. MR. SCAMMON.

#### COURSES PRIMARILY FOR GRADUATE STUDENTS

201f-202w-203s-204su. RESEARCH IN ANATOMY. Qualified students may undertake the investigation of problems in anatomy, including histology, embryology, and neurology. Special facilities are offered to graduate students in the clinical departments for work upon problems in applied anatomy. DR. JACKSON, MR. JOHNSTON, DR. LEE, MR. SCAMMON, MR. RASMUSSEN.

205f-206w-207s. ANATOMICAL SEMINAR. Reviews of the current literature and discussion of research work being carried on in the department. Reading knowledge of French and German required. DR. JACKSON

#### BACTERIOLOGY AND IMMUNOLOGY

Professors WINFORD P. LARSON, EDWARD C. ROSENOW,\* Associate Professors ARTHUR T. HENRICI, ARTHUR H. SANFORD.\*

##### A. COURSES OFFERED AT MINNEAPOLIS

101f,su. SPECIAL BACTERIOLOGY FOR MEDICAL STUDENTS. The study of pathogenic bacteria, especially in relation to definite diseases; bacteriological methods in clinical diagnosis; principles of infection and immunity, with practical application of serum reactions. Fourth-year medical students and others. Prerequisite: general bacteriology. Sixty-six hours; 4 credits. DR. LARSON and assistants.

105f. HOUSEHOLD BACTERIOLOGY. The decay, fermentation, and putrefaction of foodstuffs; molds; canning; bacterial food poisoning; bacteriology of the cleansing processes. Prerequisite: general bacteriology. Forty-four hours; 3 credits. MISS BENTON.

114s. THE HIGHER BACTERIA. Study of morphology, cultivation, and classification of actinomycetes, yeasts, and molds. Study of the mycoses. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. DR. HENRICI.

116w. COURSE IN IMMUNITY. Laws of hemolysis. Quantitative relationship between antigen and antibody. Wassermann reaction. Opsonins. Vaccines. Precipitin reaction. Blood grouping. Abderhalden reaction. Anaphylaxis. Fifth- and sixth-year medical students. Limited to ten students. Forty-four hours; 3 credits. DR. LARSON.

- 117s. PATHOGENIC PROTOZOA. Study of parasitic protozoa in men, including spirochaets; their morphology and life histories; intermediate hosts as agents in the spread of disease; cultural methods. Prerequisites: general and special bacteriology; Animal Biology 45 and 107. Forty-four hours; 3 credits. DR. LARSON.
- 118f. MORPHOLOGY AND TAXONOMY OF BACTERIA. Cytology of bacteria; their origin and systematic position; consideration of morphological, biochemical, and immunological characters as data for classification; variations and mutations in bacteria; the biometrical method as applied to bacteriology. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. DR. HENRICI.
- 119f. BACTERIOLOGICAL CHEMISTRY. Chemical analyses of bacteria; physical agents influencing bacterial metabolism (salinity, hydrogen-ion concentration, surface tension, etc.); factors stimulating enzyme production; protein, carbohydrate, and fat metabolism of bacteria; nitrogen fixation. Prerequisites: general and special bacteriology; physiologic chemistry or phytochemistry. Sixty-six hours; 4 credits.
- 120w. CONTINUATION OF 119f. Bacterial toxins; "split proteins"; bacterial activity in the alimentary tract; pigment production; autolysis of bacteria; immunochemistry; permeability of bacterial cells; behavior of bacteria toward electricity. Sixty-six hours; 4 credits.
- 150f-151w (or 150w-151s). ADVANCED BACTERIOLOGY. An advanced course giving additional work in bacteriology and the opportunity of working out special problems. Limited to ten students. Forty-four hours; 3 credits. DR. LARSON, DR. HENRICI.
201. RESEARCH IN BACTERIOLOGY. Graduate students of the necessary preliminary training may elect research, either as majors or minors, in bacteriology. Hours and credits arranged. DR. LARSON, DR. HENRICI.
203. SEMINAR IN BACTERIOLOGY. One credit.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities for work in bacteriology and immunology on the Mayo Foundation are in connection with routine clinical examinations and in special research. They are most desirable as minors for fellows fitting themselves for clinical fields, as internal medicine, surgery, urology, and for fellows majoring in pathology, or as major subjects for fellows desiring to specialize in these fields.

The graduate courses in bacteriology are open to students with previous training in bacteriology, holding only their baccalaureate or Master's degrees in arts or science, as well as to graduates in medicine. They are designed to train well-equipped students for special work in bacteriologic diagnosis and research, and for the teaching of bacteriology.

M151f,w,s,su. CLINICAL BACTERIOLOGY. Making and examination of cultures; preparation and administration of autogenous vaccines; Wassermann tests; special clinical laboratory methods, and opportunity for clinical or bacteriological research. DR. SANFORD.

M251f,w,s,su. EXPERIMENTAL BACTERIOLOGY. Research in the bacteriology of normal and diseased tissues, the blood, secretions, and exudates. Experimental inoculation of animals and immunological studies. Study of the therapeutic value of dead bacteria. DR. ROSENOW.

### MEDICINE

(Including General Medicine, Dermatology and Nervous and Mental Diseases)

Professors REGINALD FITZ,\* ARTHUR S. HAMILTON, THOMAS S. HARTZELL, HENRY S. PLUMMER,\* LEONARD G. ROWNTREE,\* WALTER D. SHELDEN,\* JOHN H. STOKES,\* S. MARX WHITE; Associate Professors GEORGE B. EUSTERMAN,\* HERBERT Z. GIFFIN,\* WILLIS S. LEMON,\* ARCHIBALD H. LOGAN,\* ROBERT D. MUSSEY,\* ARTHUR H. SANFORD,\* JOHN P. SCHNEIDER, HENRY L. ULRICH; Assistant Professors WALTER M. BOOTHBY,\* DORR F. HALLENBECK,\* NORMAN M. KEITH,\* WILLIAM A. PLUMMER,\* ERNEST T. F. RICHARDS, LEDA J. STACY,\* RUSSELL M. WILDER,\* HENRY W. WOLTMANN;\* Instructors DAVID M. BERKMAN,\* MAURICE B. BONTA,\* HARRY M. CONNER,\* FRED W. GAARDE,\* HOWARD R. HARTMAN,\* LEE W. POLLOCK,\* IRENE SANDIFORD,\* FREDERICK A. WILLIUS.\*

The graduate work in the Department of Medicine is designed to prepare students for practice of the specialty of internal medicine, research in the problems of general medicine, and for the specialty of nervous and mental diseases, as the case may be, and to train men as teachers in their respective fields. Prospective students who have had no special work in addition to that of the undergraduate course in physiology, physiologic chemistry, therapeutics, experimental medicine, or pathology are advised to devote a year or more to these subjects before entering the regular three-year graduate courses. It is recommended that a minor be carried throughout the course in one or more of the following departments: Physiology, Pharmacology, Pathology, and Immunology. For students specializing in nervous and mental diseases, minors in anatomy and psychology are especially valuable, and for those desiring it, work could be arranged in the Department of Ophthalmology and Oto-Laryngology, giving a special opportunity to study lesions of the eye occurring in systemic disorders. In the Medical School, during at least the third year of the three-year fellowship, the fellow acts as an officer of the clinic with definite responsibility in the care of patients in the University Hospital.

### A. COURSES OFFERED AT MINNEAPOLIS

201f,w,s,su. CLINICAL MEDICINE. Study of general diagnosis and methods of investigation and recording clinical data. The laboratory of experimental medicine is open for study of special problems arising in the



investigation of cases. Emphasis placed on methods of treatment  
DR. WHITE, DR. SCHNEIDER, DR. RICHARDS.

202f,w,s,su. DISEASES OF CARDIOVASCULAR APPARATUS. Special study of diseases of the heart and blood-vessels, including technic and application of the polygraphs, electrocardiograph, and interpretation of outlines of the heart and great vessels obtained by means of the radiograms and orthodiagram. DR. WHITE.

203f,w,s,su. RESEARCH IN MEDICINE. University Hospital and Out-Patient Department. DR. WHITE, DR. SCHNEIDER, DR. RICHARDS.

204f,w,s,su. PROBLEMS IN MEDICINE. Specific problems in diagnosis and treatment, including problems in immunology viewed from the clinical standpoint. General Hospital. DR. ULRICH.

205f,w,s,su. RESEARCH IN MOUTH INFECTIONS. A study of dental and paradental infections as related to systemic disease. Experimental study to determine the lesion produced in animals by bacteria from these sources. DR. HARTZELL.

206f,w,s. PATHOLOGY OF THE NERVOUS SYSTEM. The preparation of gross and microscopic material from diseased nerve tissues; the relations existing between pathologic lesions, signs, and symptoms; the chief neuron systems and principles underlying their degeneration. DR. HAMILTON.

207f,w,s,su. CLINICAL NEUROLOGY. Advanced diagnosis of nervous diseases; practical experience in diagnostic procedures employed in the study of diseases of the nervous system. DR. HAMILTON.

208f,w,s,su. NEUROLOGIC RESEARCH. DR. HAMILTON.

209f,w,s,su. ADVANCED NEUROPATHOLOGY. DR. HAMILTON.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The work in internal medicine at Rochester consists of history-taking, physical examinations, the recommendation of patients for special examinations with correlation of results thereof, and the formation of independent judgments concerning diagnoses, and indications and recommendations for medical and surgical treatment, all under the immediate direction of the chief of the section and his associate or his first assistant. Each service consists of six half days each week for six months (except as noted) in a clinical section. The alternate half days are available for clinical demonstrations in other sections, the study and correlation of the literature, histories, specimens, etc., of selected groups of cases, and of experimental laboratory or other research work. A seminar is held at least once a week in each section for the discussion of the group of cases to which special attention is given in the section. Fellows majoring in internal medicine take a minimum of four services of six months each in clinical or laboratory diagnosis.

- MI51f,w,s,su. LABORATORY OF HEMATOLOGY AND URINALYSIS. DR. SANFORD.
- MI52f,w,s,su. GASTROLOGICAL LABORATORY. DR. SANFORD.
- MI53f-w,w,s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the gastro-intestinal and accessory digestive tracts. DR. EUSTERMAN, DR. BERKMAN, DR. HARTMAN.
- MI54f,w,s,su. CLINICAL DEMONSTRATION of diseases of the gastro-intestinal and accessory digestive tracts. Twenty-four hours. DR. EUSTERMAN, DR. HARTMAN.
- MI55f-w,w,s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the intestines. DR. LOGAN, DR. POLLOCK.
- MI56f,w,s,su. CLINICAL DEMONSTRATION of diseases of the intestines. Twenty-four hours. DR. LOGAN, DR. POLLOCK.
- MI57f,w,s,su. PROCTOLOGY. DR. LOGAN, DR. POLLOCK.
- MI58f-w,w,s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the chest. DR. LEMON, DR. CONNER, DR. GAARDE.
- MI59f,w,s,su. CLINICAL DEMONSTRATION of diseases of the chest. Forty-eight hours. DR. LEMON, DR. CONNER, DR. GAARDE.
- MI60f-w,w,s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the blood and blood-forming organs. DR. GIFFIN, DR. BONTA.
- MI61f,w,s,su. CLINICAL DEMONSTRATION of diseases of the blood and blood-forming organs. Twenty-four hours. DR. GIFFIN, DR. BONTA.
- MI62f-w,w,s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the cardio-vascular system, dustless glands, and esophagus. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS.
- MI63f,w,s,su. CLINICAL DEMONSTRATION of diseases of the thyroid. Twenty-four hours. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS.
- MI64f,w,s,su. CLINICAL DEMONSTRATION of diseases of the cardio-vascular system and esophagus. Twenty-four hours. DR. H. S. PLUMMER, DR. WILLIUS.
- MI65f-w,w,s,s-su,su-f. DIAGNOSIS AND RESEARCH (clinical and laboratory) in cardio-renal and vascular and metabolic diseases. DR. ROWNTREE, DR. FITZ, DR. KEITH, DR. WILDER.
- MI66f,w,s,su. CLINICAL DEMONSTRATION of cardio-renal, vascular, and metabolic diseases. Twenty-four hours. DR. ROWNTREE, DR. FITZ.

- M167f,w,s,su. CLINICAL DEMONSTRATION of pancreatitis and diabetes. Twenty-four hours. DR. WILDER.
- M168f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of pelvic organs. DR. MUSSEY.
- M169f,w,s,su. CLINICAL DEMONSTRATION of general medical and surgical cases. Twenty-four hours. DR. MUSSEY.
- M170f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to gynecology. DR. STACY.
- M171f,w,s,su. RADIUM AND ROENTGEN THERAPY. DR. STACY.
- M172f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to acute emergency conditions. DR. HALLENBECK.
- M173f-w,w-s,s-su,su-f. GENERAL DIAGNOSIS IN NEUROLOGY AND PSYCHIATRY. DR. SHELDEN, DR. WOLTMANN.
- M174f,w,s,su. CLINICAL DEMONSTRATION of neurological diseases. Twenty-four hours. DR. SHELDEN, DR. WOLTMANN.
- M175f,w,s,su. GENERAL DIAGNOSIS with special reference to dermatology and syphilology. All day. DR. STOKES.
- M176f,w,s,su. CLINICAL DEMONSTRATION OF DERMATOLOGIC AND SYPHILOLOGIC MATERIAL. Twenty-four hours. DR. STOKES.
- M251f,w,s,su. ADVANCED WORK IN ELECTROCARDIOGRAPHIC LABORATORY. DR. H. S. PLUMMER, DR. WILLIUS.
- M252f,w,s,su. METABOLIC LABORATORY. Respiratory exchange and allied physiologic problems. DR. BOOTHBY, MISS SANDIFORD.
- M253f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M153 or M155. Twelve hours. DR. EUSTERMAN, DR. HARTMAN.
- M254f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M156 and M157. Twelve hours. DR. LOGAN, DR. POLLOCK.
- M255f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M158. Sixty hours. DR. LEMON, DR. CONNER, DR. GAARDE.
- M256f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M160. Twelve hours. DR. GIFFIN, DR. BONTA.
- M257f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M162, M251, or M252. Twelve hours. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS.

- M258f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M165. Twelve hours. DR. ROWNTREE, DR. FITZ, DR. KEITH, DR. WILDER.
- M259f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M168 or M172. Twelve hours. DR. MUSSEY, DR. HALLENBECK.
- M260f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M170 or M171. Twelve hours. DR. STACY.
- M261f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M173. Twelve hours. DR. SHELDEN, DR. WOLTMANN.
- M262f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M175. Twenty-four hours. DR. STOKES.
- M263f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies in nephritis, acidosis, diseases of the liver and of the blood, together with research work along biochemical lines. DR. ROWNTREE, DR. FITZ.
- M264f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies in nephritis and diabetes, together with research work along biochemical lines. DR. WILDER.
- M265f,w,s,su. RESEARCH IN MEDICINE. DR. ROWNTREE, DR. WILDER.

## OBSTETRICS AND GYNECOLOGY

Professor JENNINGS C. LITZENBERG; Associate Professor FRED L. ADAIR;  
Assistant Professor LEE W. BARRY.

Of the courses in other departments open to graduate medical students, the following are especially recommended for those desiring to specialize in obstetrics and gynecology.

Advanced Anatomy: gross and histological, of the female generative organs (Anatomy 153f-154w-155s-156su)

Fetal Anatomy: dissection of fetus and new-born (Anatomy 133f and 134f,s,su)

Implantation and Placentation (Anatomy 137f,w,s)

Advanced Physiologic Chemistry (Physiology 153f,w,s,su)

Gynecological Pathology (Pathology 118s)

Experimental Pharmacology (Pharmacology 104, 109a,b)

Other courses in fundamental or clinical subjects may be elected.

The following graduate courses are offered in the Department of Obstetrics and Gynecology (at Minneapolis):

107f-108w-109s-110su. ADVANCED PATHOLOGY OF THE FEMALE GENERATIVE ORGANS. Required of first- or second-year fellows in obstetrics and gynecology. Prerequisite: Pathology 108, or equivalent. DR. ADAIR.

- 111f-112w-113s-114su. CLINICAL OBSTETRICS AND GYNECOLOGY. A course in diagnosis and treatment, with special study of selected cases. Clinic in the Out-Patient Department of the University Hospital, MWF, throughout the year. Required of first-year fellows, and may be elected by second-year fellows. DR. LITZENBERG, DR. ADAIR, DR. BARRY.
- 115f-116w-117s-118su. CLINICAL OBSTETRICS AND GYNECOLOGY. Similar to Course 111-114, but on TThS. Required of second-year fellows, and may be elected by first-year fellows. DR. LITZENBERG, DR. ADAIR, DR. BARRY.
- 119f-120w-121s-122su. ADVANCED OBSTETRICS AND GYNECOLOGY. Includes service in the University Hospital, affording ample opportunity for experience in diagnosis, care, and treatment (operative and non-operative) of patients. Special facilities offered for study of problems and cases of unusual interest. Required of first-year fellows. DR. LITZENBERG.
- 123f-124w-125s-126su. Similar to Course 119-122, but more advanced, both in clinical and research aspects of the subjects, so as to be adapted to the increased training and experience. Required of second-year fellows. DR. LITZENBERG.
- 127f-128w-129s-130su. Similar to Courses 119-122 and 123-126, but more advanced. Required of third-year fellows. DR. LITZENBERG.
- 201f-202w-203s. SEMINAR. A conference, including the fellows and graduate students. Presentation and discussion of original work and reports upon the current literature in obstetrics and gynecology. Reading knowledge of French and German is necessary. DR. LITZENBERG.
- 205f-206w-207s-208su. RESEARCH. Clinical and laboratory research upon problems in obstetrics and gynecology. Required of third-year fellows, who must complete a satisfactory thesis during the year. Elective for second-year fellows or other properly qualified graduate students. DR. LITZENBERG, DR. ADAIR, DR. BARRY.

## OPHTHALMOLOGY AND OTO-LARYNGOLOGY

Professors WILLIAM R. MURRAY, WILLIAM L. BENEDICT,\* HAROLD I. LILLIE,\* GORDON B. NEW;\* Associate Professor FRANK E. BURCH; Assistant Professors ROY A. BARLOW,\* HORACE NEWHART; Instructors HORACE R. LYONS,\* AVERY D. PRANGEN.\*

The graduate courses in these subjects are designed to prepare selected men for advanced work in the various lines, to prepare them for practice in these specialties, and to develop research and productive work in these subjects.

Of elective courses in other departments, the following are highly desirable.



Physics of Light and Acoustics

Advanced Optics

Advanced Anatomy of the Head and Neck

Topographic Anatomy of the Head and Neck

Advanced Histology and Embryology of the Eye, Ear, Nose, and Throat

Advanced Physiology of Vision and Hearing

Physiologic Optics Seminar

Special Pathology of the Eye, Ear, Nose, and Throat

Immunity

Advanced Neuropathology

The following courses are offered within the department:

A. COURSES OFFERED AT MINNEAPOLIS

124f. ANOMALIES OF THE OCULAR MUSCLES. DR. BURCH.

125w. COURSES ON VISUAL FIELD: PERIMETRY. DR. BURCH.

131f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE EYE. Demonstrations upon the cadaver and live and dead animal eyes, with the usual operative procedures of practical value. Each graduate student will perform all the usual operations upon the cadaver and animals. Two and one-half hours a week. DR. MURRAY, DR. BURCH, DR. NEWHART.

132f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE NOSE AND THROAT. A course consisting of demonstrations upon the cadaver and the usual operative procedures of practical value. Each student will be given an opportunity to do work in the laboratory, performing all usual and practical operations. Two hours a week. DR. MURRAY, DR. NEWHART.

133f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE TEMPORAL BONE. A course of eight to twelve hours consisting of demonstrations and exercises on the cadaver at the Institute of Anatomy. Limited to four students. DR. MURRAY, DR. NEWHART.

134f,w,s,su. OPERATIVE SURGERY ON THE LABYRINTH. A course consisting of lectures and practical demonstrations of diagnostic methods. Eight hours; Millard Hall. DR. MURRAY, DR. NEWHART.

135f,w,s,su. ADVANCED COURSE IN REFRACTION WORK. A course consisting of eight lectures and illustrated demonstrations upon the errors of refraction and motor anomalies, supplemental and practical work in out-patient clinic on the refraction work. DR. MURRAY, DR. BURCH.

138f,w,s,su. ADVANCED OPHTHALMOSCOPY. Training in the use of the ophthalmoscope by (a) direct method, and (b) indirect method. Examination in detail of the normal fundus oculi. Diagnosis of abnormalities (a) in the media, (b) in the fundus oculi. DR. MURRAY, DR. BURCH.

139f,w,s,su. ADVANCED OPHTHALMOLOGY. Three years' service in the wards and Out-Patient Department of the University Hospital with clinic and

laboratory research. Those taking this course will act as assistants in out-patient clinics in operative and other clinical work. DR. MURRAY and assistants.

141f,w,s,su. **ADVANCED OTO-LARYNGOLOGY.** Three years' service in the wards of the University Hospital and Out-Patient Department with clinic and laboratory research. Those taking this course will act as assistants in out-patient clinics in operative and other clinical work. DR. MURRAY and assistants.

145f,w,s,su. **CLINICAL OPHTHALMOLOGY AND OTO-LARYNGOLOGY.** Special half-time assistantship and service in the private clinic of Associate Professor Burch. A systematic course of assigned reading and study with final examination, is included. For credit beyond one year, work in investigation must be included. DR. BURCH.

146s. **DIAGNOSIS AND THERAPEUTICS OF DISEASES OF THE EAR.** DR. NEWHART.

147f,w,s,su. **PRACTICAL WORK IN REFRACTION.** Prerequisite: Course 135. DR. MURRAY, DR. BURCH.

201f,w,s,su. **SEMINAR IN OPHTHALMOLOGY AND OTO-LARYNGOLOGY.** Given by members of the staff and open to fellows, scholars, and other properly qualified graduate students. DR. MURRAY, DR. BURCH, DR. NEWHART.

203f,w,s,su. **RESEARCH.** Each graduate student will be required to pursue some line of original research in ophthalmology or oto-laryngology. DR. MURRAY, DR. BURCH, DR. NEWHART.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

Fellows majoring in ophthalmology in the Mayo Foundation usually spend nine months on the physics of light, physiologic optics, and anatomy, pathology, and bacteriology of the eye in the Medical School in Minneapolis. The remainder of their service is composed of the following:

M151f,w,s,su. **REFRACTION.** Theory of refraction, retinoscopy, diagnosis of refractive errors of the eye, prescribing of lenses, practical work on patients under supervision of instructor. Shop work. DR. PRANGEN.

M151f,w,s,su. **OPHTHALMIC MYOLOGY.** Eye movements, disturbances of motility of the eyes. DR. BENEDICT, DR. PRANGEN.

M153f,w,s,su. **CLINICAL OPHTHALMOLOGY.** External diseases of the eye, ophthalmoscopy, perimetry, ophthalmic surgery. Practical work with patients except surgical. DR. BENEDICT.

M154f,w,s,su. **MEDICAL OPHTHALMOLOGY.** Ophthalmology in relation to general diseases, diseases of the nervous system and clinical diagnosis, advanced physiology of the eye, psychology of vision, functional eye disturbances. Lectures and demonstrations. Half-time. DR. BENEDICT.

M155f. PHYSICS OF LIGHT. Physiologic optics. Lectures and demonstrations. DR. PRANGEN.

M156f,w,s,su. CLINICAL DEMONSTRATION of diseases of the eye. Twenty-four hours. DR. BENEDICT.

NOTE: Pathology of the eye; lectures and demonstrations; laboratory facilities for research. Bacteriology of the eye; laboratory work; animal experimentation; laboratory facilities for research.

Fellows majoring in oto-laryngology and rhinology in the Mayo Foundation usually spend the forenoons of their first nine months as interns in the Worrell Hospital where they act as second assistants in the operating rooms, and their afternoons in the examination of patients in the clinic. In the forenoons of their second nine months they are on out-patient service in the clinic, and in the afternoons they examine patients. In the forenoons of their third nine months they act as first assistants at operations in the Worrell Hospital and in the afternoon they examine patients. During this period they have special opportunity to do equilibration work. Service in the minor, usually pathology or bacteriology, in neurology, in laryngology, oral and plastic, in ophthalmology, is preferably taken before beginning work in oto-laryngology or after the completion of that service.

M157f,w,s,su. CLINICAL OTO-LARYNGOLOGY AND RHINOLOGY. Theory and practice with differential diagnosis of diseases of the ear, nose, accessory sinuses, pharynx, and larynx and their relations to general diagnosis. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.

M158f,w,s,su. PREOPERATIVE AND POSTOPERATIVE CARE OF PATIENTS. Treatment of complications. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.

M159f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. Internship, second assistantship in operating service in Worrell Hospital. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.

M160f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. First assistantship in operative service in Worrell Hospital. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.

M161f,w,s,su. LARYNGOLOGY, ORAL AND PLASTIC. Clinical and surgical. Neoplasms of the nose, throat, mouth, and neck. Diagnosis of laryngeal pathology. Plastic surgery of the face, mouth, and neck. Radium treatment. DR. NEW.

#### PATHOLOGY AND PUBLIC HEALTH

Professors WILLIAM C. MACCARTY,\* ELEXIOUS T. BELL, HAROLD E. ROBERTSON,\* ARTHUR H. SANFORD,\* JOHN SUNDWALL, LOUIS B. WILSON;\* Assistant Professors THOMAS B. MAGATH,\* ALBERT C. BRODERS.\*

Graduate students who desire to take their major or minor work in pathology must present credit in the following subjects: physics, 8 credits; general and organic chemistry, 12 credits; zoology, 6 credits; and a reading knowledge of German.

In addition, students who elect their major work in pathology must present credits for the equivalent of the two years' work of the Medical School of this University.

#### A. COURSES OFFERED AT MINNEAPOLIS

103su,w. PREVENTIVE MEDICINE AND HYGIENE. A systematic study of the principles of personal and communal hygiene and of general procedures for the protection of the public health. Thirty-three hours; 3 credits. DR. SUNDWALL.

104f,w,s. AUTOPSIES. Technic of performing autopsies; making autopsy records; examination of fresh organs removed from these autopsies. Opportunities afforded to study observed lesions microscopically. Three or four students called to each post-mortem; excused from regular classes. The staff.

#### ELECTIVE COURSES<sup>1</sup>

106. PATHOLOGIC TECHNIC. General and special methods of preparation of microscopic and gross pathologic specimens; including practice with freezing microtome, celloidin and paraffin embedding methods, general and special stains, preparation of museum specimens, etc.

107f,w,s. APPLIED PATHOLOGY. Laboratory studies in the examination of routine operative and autopsy specimens, with investigation of special associated problems. Credit for work in this course is to be judged entirely by character and amount of work accomplished. Dates and hours arranged.

108. DIAGNOSIS OF TUMORS. The study of tumors and other pathologic conditions simulating tumor formation.

109. CLINICAL PATHOLOGICAL CONFERENCE. Presentation and comparison of clinical data on selected cases by clinicians, and of the pathological specimens from these same cases, by the pathologist, with discussions of the problems of etiology and diagnosis. One hour per week in each quarter.

Electives in coöperation with the respective clinical branches. Studies of the pathologic conditions found in the diseases peculiar to each of the specialties listed below. Lesions demonstrated by gross and microscopic specimens.

#### 110. GYNECOLOGICAL PATHOLOGY.

<sup>1</sup> Elective courses offered in two, three, or four quarters. Special programs issued for each quarter. Assignment of elective courses to individual staff members will appear in quarterly programs.

## 111. NEUROPATHOLOGY.

## 112. SURGICAL PATHOLOGY.

## 113. PATHOLOGY OF DISEASES OF THE EYE, EAR, NOSE, AND THROAT.

## 114. PATHOLOGY OF DISEASES OF CHILDREN.

201. RESEARCH. Graduate students, of the necessary preliminary training, may elect research, either as majors or minors in pathology. Hours and credits to be arranged.

## B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The graduate work in pathology offered in the Mayo Foundation is planned primarily to give opportunity to fellows majoring in clinical branches to study the pathological aspects of diseases in those fields in which they are specially interested. Opportunity is also offered for a small number of fellows to major in pathology with their minor in bacteriology, or vice versa.

- M151f,w,s,su. PARASITOLOGY. Routine clinical and special research in parasitology, examination of stools, study of internal parasites. DR. MAGATH.

- M152f,w,s,su. CLINICAL PATHOLOGY. Making and examination of cultures, preparation and administration of autogenous vaccines, Wassermann tests, special clinical and laboratory methods including hematology and serology and opportunity for research. DR. SANFORD.

- M153f,w,s,su. LABORATORY DEMONSTRATION of clinical laboratory methods. DR. SANFORD, DR. MAGATH.

- M154f,w,s,su. CLINICAL CHEMISTRY. Studies in the newer methods of blood chemistry. DR. SANFORD, DR. MAGATH.

- M155f-w,w-s,s-su,su-f. NECROPSY SERVICE. Junior assistant three months; senior assistant three months; demonstrations in clinico-pathologic conferences; microscopic examination of fixed tissues removed at necropsy and operations. DR. ROBERTSON.

- M156f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at necropsy and operation. DR. ROBERTSON.

- M157f-w,w-s,s-su,su-f. SURGICAL PATHOLOGY. Pathologic diagnosis of surgical specimens at operation, gross and microscopic; study of fresh tissues. DR. MACCARTY, DR. BRODERS.

- M158f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at operation. DR. MACCARTY, DR. BRODERS.

- M251f,w,s,su. RESEARCH STUDIES IN SPECIAL PATHOLOGY; special pathology of various organs; gross and microscopic study of lesions; research work on assigned problems in the several fields. DR. WILSON.



M252f,w,s,su. RESEARCH STUDIES upon the etiology of neoplasms and clinico-pathologic standardization. DR. MACCARTY, DR. BRODERS.

M253f,w,s,su. RESEARCH WORK on assigned problems in experimental pathology. DR. MANN.

M254f,w,s,su. RESEARCH WORK in clinical pathology. DR. SANFORD, DR. MAGATH.

### PEDIATRICS

Professors HENRY F. HELMHOLZ,\* JULIUS P. SEDGWICK; Associate Professors SAMUEL AMBERG,\* WALTER R. RAMSEY, FREDERICK C. RODDA; Assistant Professors EDGAR J. HUENEKENS, MAX SEHAM, ROOD TAYLOR; Instructor NABOTH O. PEARCE.

The graduate work of the Department of Pediatrics is arranged with the intention (a) of preparing students to become competent pediatricists; (b) to put them in position to attack original pediatric problems; and (c) to make them competent teachers in the subject.

As a prerequisite a general understanding of physiologic and analytic chemistry and a working knowledge of French and German are essential.

Prospective students will find preparatory study in physiology and quantitative analysis of value.

Students will be encouraged to carry a minor in some of the fundamental branches.

#### A. COURSES OFFERED AT MINNEAPOLIS

The following electives in other departments are desirable. (For further information see description of courses under departmental headings.)

- Quantitative Analysis
- Organic Chemistry
- Physical Chemistry
- Mental Retardation
- Physiologic Chemistry
- Physiology of Muscle, Nerve, Blood, Circulation, and Digestion
- Physiology of the Nervous System and Special Senses: Respiration.
- Metabolism, Nutrition, and Excretion
- Physical Chemistry of Cells
- Electrophysiology
- Metabolism
- Quantitative Methods
- Human Neurology
- Fetal Anatomy
- General Roentgenologic Technic
- Interpretations of Roentgenologic Findings
- Hematology
- Course in Immunity
- The Physiological and Chemical Basis of Pharmacology (Pharmacology

Diseases of Cardio-Vascular Apparatus (Medicine 123-124)  
 Medical Chemistry  
 Orthopedic Service  
 Orthopedic Diagnosis  
 Advanced Ophthalmoscopy

103f,w,s,su. CLINIC IN PEDIATRICS. Conducted at the University Hospital and the General Hospital; a part of course in required clinics.

104f,w,s,su. CONTAGIOUS DISEASES. The advanced study of contagious diseases, including the practice of intubation and tracheotomy, with training upon the cadaver.

111. DISEASES OF THE NEW-BORN.

115. THEORY AND PRACTICE OF INFANT-FEEDING, including diseases of the gastro-intestinal tract.

117. PEDIATRIC CLINIC. Out-Patient clinic; University Hospital.

125f,w,s,su. SPECIAL GRADUATE CONTAGIOUS COURSE. Advanced study of contagious diseases, including practice of intubation with training upon the cadaver and the living dog. Limited to graduates.

127f,w,s,su. THESIS COURSE.

129f,w,s,su. PEDIATRICS SEMINAR.

130f,w,s,su. Course consisting of three to six months' residency in pediatrics and contagious diseases at General Hospital.

142. PREPARATION OF INFANT FOODS. Practical work.

144. CONTAGIOUS DISEASES. Advanced study of contagious diseases.

200-201. ADVANCED STUDY IN DISEASES OF INFANTS AND CHILDREN.

202-203. RESEARCH IN DISEASES OF NEW-BORN. Students undertaking this work should have had the equivalent of Fetal Anatomy and Pediatrics III.

204-205. RESEARCH IN PHYSIOLOGY OF NEW-BORN. Prerequisite: Pediatrics III. Prerequisite preparation in physiology will depend upon the type of work undertaken.

206-207. RESEARCH IN DISEASES OF INFANTS AND GROWING CHILDREN. Prerequisite work will depend upon the type of work undertaken.

208-209. RESEARCH IN PHYSIOLOGY OF INFANTS AND GROWING CHILDREN. Prerequisite preparation will depend upon the type of work undertaken.

210-211. RESEARCH IN ANATOMY OF INFANTS AND GROWING CHILDREN. Prerequisite preparation will depend upon the type of work undertaken.

## B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities offered in pediatrics in the Mayo Foundation are designed for the purpose of training a few selected men for the special practice of pediatrics. The courses are also valuable to students majoring in special clinical fields.

MI51f-w,w-s,s-su,su-f. DIAGNOSIS OF MEDICAL AND SURGICAL DISEASES OF INFANCY AND CHILDHOOD. DR. HELMHOLZ, DR. AMBERG.

MI52f,w,s,su. CLINICAL DEMONSTRATION of diseases of infancy and childhood. Twenty-four hours. DR. HELMHOLZ, DR. AMBERG.

MI53f-w,w-s,s-su,su-f. PREVENTIVE PEDIATRICS. Twenty-four hours. Limited to two fellows. DR. HELMHOLZ, DR. AMBERG.

M251f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course MI51. DR. HELMHOLZ, DR. AMBERG.

M252f-w,w-s,s-su,su-f. RESEARCH IN DISEASES OF INFANCY AND CHILDHOOD. DR. HELMHOLZ, DR. AMBERG.

## PHARMACOLOGY AND THERAPEUTICS

Professor ARTHUR D. HIRSCHFELDER; Associate Professor EDGAR D. BROWN.

102s. GENERAL PHARMACOLOGY. The principles underlying the structure, physico-chemical properties, physiologic, therapeutic, and toxic actions of substances, natural or synthetic, used as medicines. At least one quarter of physiology is prerequisite. Twenty-two hours. DR. HIRSCHFELDER, DR. BROWN.

104s. EXPERIMENTAL PHARMACOLOGY. Exercises illustrating the preparation and actions of medicine, their relation to chemical structure and their mode of administration. At least one quarter of physiology is prerequisite. Sixty-six hours. DR. HIRSCHFELDER, DR. BROWN.

105su,f or w,s. GENERAL PHARMACOLOGY AND THERAPEUTICS. A more detailed study of drugs important in clinical practice, covering the relations of chemical structure to physiologic and therapeutic action and modes of application in clinical medicine. Sixty-four hours. DR. HIRSCHFELDER, DR. BROWN.

109. PHARMACOLOGICAL PROBLEMS. Special investigations and experimental study of one or more of the following topics: anesthetics; circulatory stimulants and depressants; drugs acting upon the kidneys; urinary antiseptics; poisons and antidotes; effects of common harmless drugs; internal secretions; action of drugs upon parasites, tumors, etc. Hours and credits by arrangement. DR. HIRSCHFELDER, DR. BROWN.

110. POISONS. Their detection, actions, and antidotes. Forty-eight hours. DR. BROWN.

112. PRACTICAL MATERIA MEDICA. The study of crude drugs, pharmaceutical preparations, and the flavoring and compounding of prescriptions. Eight hours. DR. BROWN.
- 113f. THE PHYSIOLOGICAL AND CHEMICAL BASIS OF PHARMACOLOGY. The relation of drug action to chemical structure; the mode of action and therapeutic application of various synthetic drugs; the study of chemotherapy. An adequate training in chemistry is prerequisite. Twenty-two hours. DR. HIRSCHFELDER.
- 201f,w,s,su. SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY. Reviews of recent literature bearing upon physiologic and pharmacologic subjects. Conducted by department directors, with the collaboration of the staffs and of qualified graduate or undergraduate students. Thirty-two hours.
- 203f,w,s,su. RESEARCH IN PHARMACOLOGY. DR. HIRSCHFELDER, DR. BROWN.

### PHYSIOLOGY AND PHYSIOLOGIC CHEMISTRY

Professors EDWARD C. KENDALL,\* ELIAS P. LYON, JESSE F. MCCLENDON, FREDERICK H. SCOTT; Associate Professors RICHARD O. BEARD, FRANCIS B. KINGSBURY, CHAUNCEY J. V. PETTIBONE; Instructors CHARLES C. GAULT.

The Department of Physiology is well equipped for the various types of physiologic investigation. The library facilities are good.

For a minor or major in physiology, good courses in general zoology, general chemistry, organic chemistry, and college physics, are prerequisites. (In exceptional cases high-school physics may be accepted for a minor.) Physical chemistry is desirable.

For a minor or major in physiologic chemistry, general chemistry and organic chemistry are prerequisite, and physical chemistry and biology are desirable.

In addition, each student majoring in physiology or physiologic chemistry must have had the general courses, Physiology 100, 101, 103, 104, or the equivalent.

Students majoring in clinical subjects, and who desire to minor in physiology or physiologic chemistry, must have had the courses in these branches usually required of medical students.

A reading knowledge of German or French is required of candidates for the Master's degree in this department, and a reading knowledge of both French and German, of candidates for the Doctor's degree.

#### A. COURSES OFFERED AT MINNEAPOLIS

- 100f,su-101w,su. PHYSIOLOGIC CHEMISTRY. The components of the animal body; foods, digestion, the excreta and metabolism. Third-year medical students and others. Prerequisite: organic chemistry. One hundred ninety-eight hours; 12 credits. MR. MCCLENDON, MR. KINGSBURY, MR. PETTIBONE.

- 103f,su. **PHYSIOLOGY OF MUSCLE, NERVE, BLOOD, CIRCULATION, AND DIGESTION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. DR. LYON, MR. SCOTT, and assistants.
- 104w,su. **PHYSIOLOGY OF THE NERVOUS SYSTEM AND SPECIAL SENSES; RESPIRATION, METABOLISM, NUTRITION, AND EXCRETION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. DR. LYON, MR. SCOTT, DR. BEARD.

## ELECTIVE COURSES

- 113f,w,s,su. **PROBLEMS IN PHYSIOLOGY.** Arranged by instructors with qualified students. Each student will be assigned a topic for special laboratory study, leading in some cases to original investigation. Conferences and reading. Prerequisites: Course 103-104 or equivalent. Sixty-six hours; 3 credits or arrange. DR. LYON, MR. SCOTT, MR. MCCLENDON.
115. **APPLIED PHYSIOLOGY.** The application of physiology as a basis for interpretation of symptoms and signs of abnormal function. Three lectures weekly. Three credits. MR. GAULT.
- 131w. **ADVANCED PHYSIOLOGY OF MUSCLE, BLOOD, CIRCULATION, AND DIGESTION.** Alterations due to physiologic conditions. Prerequisite: Physiology 103. Sixty-six hours; 3 credits. MR. SCOTT.
- 132s. **ADVANCED PHYSIOLOGY OF RESPIRATION, EXCRETION, METABOLISM, NERVOUS SYSTEM, AND SENSE ORGANS.** Conferences and laboratory work. Prerequisite: Physiology 104. Sixty-six hours; 3 credits. MR. SCOTT.
- 137f,s. **FOODS AND PRACTICAL DIETETICS.** A study of human foods and food values; of the principles of food selection; of caloric indices and balanced dietaries. Exercises in the practical preparation of foods. Prerequisite: physiologic chemistry. Limited to twelve students. Sixty-six hours; 3 credits. DR. BEARD.
- 139f. **SOME NEWER ASPECTS OF NUTRITION.** Rôle of vitamins and inorganic constituents in nutrition; preservation of food to preserve vitamins; purification of vitamins; effect of vitamin deficiency on mineral metabolism; chemistry of rickets and pellagra. Prerequisite: Course 100-101. Sixty-six hours; 3 credits. MR. MCCLENDON.
- 153f,w,s,su. **ADVANCED PHYSIOLOGIC CHEMISTRY.** Course arranged by instructors with qualified students for special work. May be taken one or more quarters. Prerequisite: Course 100-101. Hours and credits arranged. MR. KINGSBURY, MR. PETTIBONE.



- 162w. CHEMICAL ANALYSIS OF BLOOD. The most recent methods in chemical analysis of blood. Limited to twelve students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. MR. KINGSBURY.
- 163s. METABOLISM. Lectures and laboratory work on special phases of metabolism. Lectures may be taken alone; number of students unlimited; laboratory course limited to ten students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. MR. PETTIBONE.
- 201f,w,s. SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY. For instructors and advanced students. Eleven hours; 1 credit. DR. HIRSCHFELDER, DR. LYON, and staff.
- 203f,w,s,su. RESEARCH IN PHYSIOLOGY. Hours and credits arranged. DR. LYON, MR. SCOTT, MR. MCCLENDON.
- 205f,w,s,su. RESEARCH IN PHYSIOLOGIC CHEMISTRY. Hours and credits arranged. MR. KINGSBURY, MR. PETTIBONE.
- 208f. SEMINAR IN PHYSIOLOGIC OPTICS. For graduate students and sixth-year medical students. Twenty-two hours; 2 credits. DR. LYON.
- 210f. PHYSIOLOGIC OPTICS. A laboratory course. For graduate and sixth-year medical students. Thirty-three hours; 1 credit. DR. LYON.

B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

M251f,w,s,su. PHYSIOLOGIC CHEMISTRY. Research work in problems related to metabolism; includes training in the use of methods of organic and inorganic analysis. DR. KENDALL.

NOTE: For course in applied physiology, see announcement of the Department of Surgery. For courses in medical chemistry, see announcement of the Department of Medicine. For courses in clinical chemistry, see announcement of the Department of Pathology.

ROENTGENOLOGY

Professor RUSSELL D. CARMAN,\* Associate Professor ALEXANDER B. MOORE,\* Instructors HOWARD O. STEARNS,\* CHARLES G. SUTHERLAND.\*

The opportunities offered in roentgenology in the Mayo Foundation are designed to permit selected men to fit themselves for advanced work in this specialty. The courses are also especially valuable for men who take them as minors in their preparation for special clinical fields. Unless the prospective student's preparation in normal anatomy, physiology, and pathology has been unusually good, at least a year should be spent in intensive study of these subjects before entering on the special three years' course.

MI51f,w,s,su. GENERAL ROENTGENOLOGIC TECHNIC. Roentgenography; plates, intensifying screens, developers; stereoscopy; roentgenoscopy; vertical, horizontal. DR. CARMAN, DR. MOORE, MR. SUTHERLAND.

- M152f,w,s,su. SPECIAL APPLICATION OF ROENTGENOLOGY. The osseous system, chest and lungs, urinary system, pyelography; gastro-intestinal tract. DR. CARMAN, DR. MOORE, DR. SUTHERLAND.
- M153f,w,s,su. ROENTGEN THERAPY. Superficial, deep; technic; apparatus; filters; dosage and measurements; cross firing; protection. DR. CARMAN, DR. MOORE.
- M154f,w,s,su. DANGERS OF THE ROENTGEN RAY. Effect upon tissues, normal and pathologic; protection, operator, patient; roentgen dermatitis, cause, results, treatment. DR. CARMAN, DR. MOORE.
- M155f,w,s,su. DEMONSTRATION of roentgenologic interpretation. DR. CARMAN, DR. MOORE.
- M156f,w,s,su. DEMONSTRATION of treatment by roentgen ray and radium. DR. CARMAN.
- M251f,w,s,su. ELECTROPHYSICS. Electricity and magnetism, phenomena, nature, and properties; source of electric energy; types of currents, continuous and alternating; units of electric measurement; resistance; Ohm's law; voltage, amperage, and wattage; the static machine; the induction coil; interrupters; condensers; the interrupterless transformer. MR. STEARNS.
- M252f,w,s,su. PHYSICS OF THE ROENTGEN RAY. History, nature, and phenomena; the vacuum tube; the roentgen tube; types, penetration, measurements. MR. STEARNS.
- M257f,w,s,su. INTERPRETATION OF ROENTGENOLOGIC FINDINGS. Normal, abnormal; roentgen signs of disease, direct, indirect; correlation of plate and screen observations; correlation of clinical and roentgen findings. DR. CARMAN, DR. MOORE.

## SURGERY

(Including Divisions of General Surgery, Experimental Surgery, Orthopedic Surgery, Urology, and Dental Surgery)

Professors WILLIAM F. BRAASCH,\* ARTHUR J. GILLETTE, MELVIN S. HENDERSON,\* E. STARR JUDD,\* FRANK C. MANN,\* CHARLES H. MAYO,\* ARTHUR C. STRACHAUER; Associate Professors DONALD C. BALFOUR,\* CARL C. CHATTERTON, J. FRANK CORBETT, BOYD S. GARDNER,\* CONRAD JACOBSON, ARTHUR A. LAW, ARTHUR T. MANN, HARRY P. RITCHIE, WALTER E. SISTRUNK,\* FRANKLIN R. WRIGHT; Assistant Professors H. CAREY BUMPUS,\* JOHN L. CRENSHAW,\* EMIL S. GEIST, VERNE C. HUNT,\* JAMES C. MASSON,\* HENRY W. MEYERDING,\* JOHN DE J. PEMBERTON,\* GILBERT J. THOMAS; Instructors STUART W. HARRINGTON,\* CARL A. HEDBLUM.\*

Dr. William J. Mayo, being a regent of the University, is not a member of the instructional staff. His services in instruction and conference, however, are available.

For courses of study offered, see special bulletin of graduate work in medicine.

#### A. COURSES OFFERED AT MINNEAPOLIS

101f,w,s. **ADVANCED MINOR SURGERY.** The student is required to assist in the out-patient surgical clinic, and in this connection makes a special study of the diagnosis and treatment of selected cases. DR. STRACHAUER.

102f,w,s. **OPERATIVE SURGERY ON THE CADAVER.** Technic of abdominal incision and closure; of bowel suturing, appendix removal, kidney exploration, nephrotomy, tracheotomy, amputations, ligations, etc. Graduate students act as laboratory assistants, and may work out upon the cadaver various independent problems in emergency surgery. DR. JACOBSON.

103f,w,s. **OPERATIVE SURGICAL TECHNIC.** A study of surgical technic by cardinal operations upon living animals. DR. JACOBSON.

105f,w,s. **PROCTOSCOPY AND SIGMOIDOSCOPY.** The treatment and diagnosis of the pathological conditions found in the lower bowel, including minor surgical operations. DR. STRACHAUER.

201w,s. **SURGERY OF THE KIDNEY.** Review of the embryology, anatomy, and pathology. Diagnosis, cystoscopic study, including kidney function estimation and pyelography; operative technic. Study of special problems involved. DR. STRACHAUER, DR. THOMAS.

204w,s. **SURGERY OF THE BRAIN AND SPINAL CORD.** Operative technic. Study of special problems involved. Prerequisites: Anatomy 103. Medicine 125. DR. STRACHAUER.

205f-206w-207s. **SURGICAL DIAGNOSIS.** In this course the graduate student assists in the practical instruction of the clinical clerks and interns in the University Hospital, and makes a special study of problems in surgical diagnosis. DR. STRACHAUER, DR. LAW, DR. RITCHIE.

208f-209w-210s. **SURGICAL SERVICE.** The graduate student acts as house surgeon, and in connection with the service is required to make a special study of the patients, preparing them for clinics and observing them after operations. DR. STRACHAUER, DR. LAW, DR. RITCHIE.

211f-212w-213s. **OPERATIVE SURGERY.** In this course the surgical fellow acts as first assistant at all operations by the surgical staff in University Hospital. When properly qualified, the fellow will be permitted to operate, beginning with simpler surgical procedures. DR. STRACHAUER, DR. LAW, DR. RITCHIE.

- 214f,w,s. ORTHOPEDIC SERVICE. Three months' service as house surgeon in the State Hospital for Crippled and Deformed Children at Phalen Park. Special facilities for the study of orthopedic diagnosis and treatment. DR. CHATTERTON.
- 215f,w,s. ORTHOPEDIC DIAGNOSIS AND TREATMENT. History-taking, physical examination, treatment, application, and use of plaster of Paris and braces. Graduate student acts as assistant in the clinic. DR. GEIST.
- 216f,w,s. SURGICAL RESEARCH. Properly qualified students may undertake original investigation of problems in either experimental or clinical surgery. The work may be used for thesis purposes. DR. STRACHAUER, DR. JACOBSON.
- 217f,w,s. SURGICAL SEMINAR. Conferences for reports on surgical literature, with presentation and discussion of specially interesting cases and research work by members of the surgical staff. DR. STRACHAUER.
- 218f,w,s. UROLOGIC DIAGNOSIS. History-taking, physical examination, and case study in diseases of the genito-urinary tract. DR. WRIGHT, DR. THOMAS.
- 219f,w,s. CYSTOSCOPY AND URETHROSCOPY. Cystoscopic examination; urethral catheterization; kidney function study; pyelography; intravesical operations; fulguration. DR. WRIGHT, DR. THOMAS.

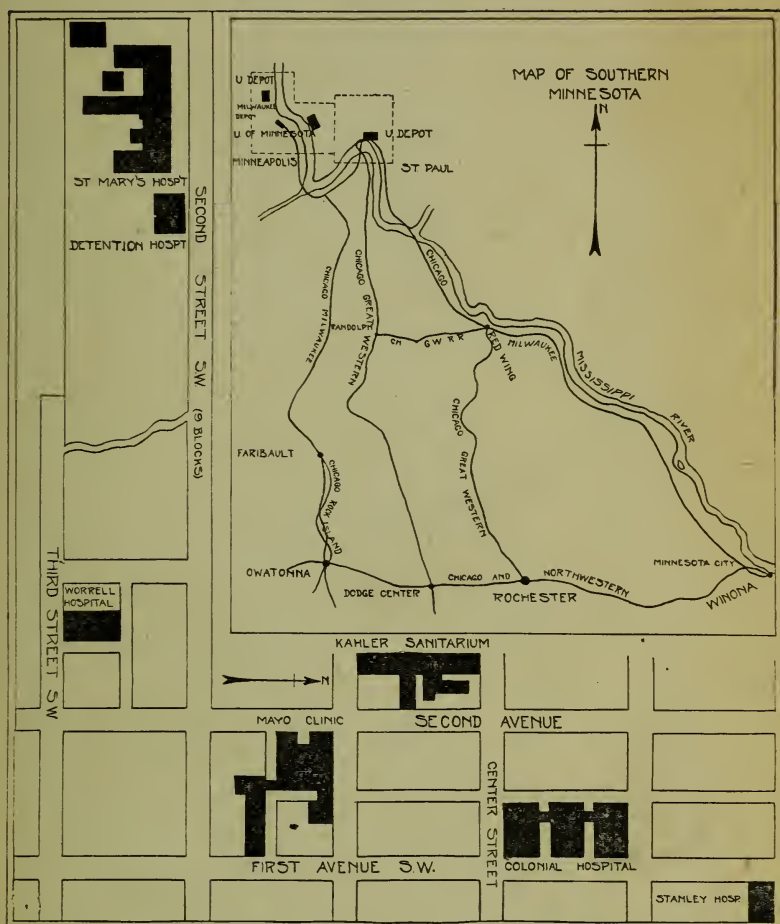
#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities for preparation in surgery in the Mayo Foundation are found largely in pathology, surgical diagnosis, and operative surgery. For work in pathology, see the Department of Pathology. For the work in surgical diagnosis, see the Department of Medicine. In the operative service the fellow acts as second assistant every second day for a period of not less than six months. On the alternate days he is charged with the post-operative care of all the patients in the operating room in which he is on service. As soon as the fellow gives evidence that he is competent to do first assisting, usually at some time within his second six months of second assistantship, he is given opportunity to act as first assistant. Selected men of the highest attainments are given opportunity for one additional year of first assisting. In all instances, attempt is made to give the most of the best service to the best men. Fellows majoring in surgery take a minimum of two services of six months in diagnosis.

Fellows majoring in orthopedic surgery usually take a minor in pathology (see Department of Pathology), one year in orthopedic diagnosis, and one year or more in orthopedic surgery.

Fellows majoring in urology usually take their minor (six months) in pathology, and a half minor (three months) in syphilology (see Course M175, Medicine). Their diagnostic service consists of twelve months in cystoscopy and urethroscopy, and six months in the hospital care of urologic cases. Their surgical work covers nine months in surgery of the abdominal and genito-urinary organs (see Course M153, Surgery).

C.  
MbbuZgrm  
1922/23



Map of a portion of Rochester showing clinics and hospitals serving the Mayo Foundation for teaching purposes



1922							1923													
JULY							JANUARY							JULY						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	..	..	..	..	..	1	..	<b>1</b>	<b>2</b>	<b>3</b>	4	5	6	1	2	3	<b>4</b>	5	6	7
2	3	<b>4</b>	5	6	7	8	7	8	9	10	11	12	13	8	9	10	11	12	13	14
9	10	11	12	13	14	15	14	15	16	17	18	19	20	15	16	17	18	19	20	21
16	17	18	19	20	21	22	21	22	23	24	25	26	27	22	23	24	25	26	27	28
23	24	25	26	27	<b>28</b>	29	28	29	30	31	..	..	..	29	30	31	..	..	..	..
30	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
AUGUST							FEBRUARY							AUGUST						
..	..	1	2	3	4	5	..	..	..	..	1	2	3	..	..	..	1	2	<b>3</b>	4
6	7	8	9	10	11	12	4	5	6	7	8	9	10	5	6	7	8	9	10	11
13	14	15	16	17	18	19	11	<b>12</b>	13	14	15	16	17	12	13	14	15	16	17	18
20	21	22	23	24	25	26	18	19	20	21	<b>22</b>	23	24	19	20	21	22	23	24	25
27	28	29	30	31	..	..	25	26	27	28	..	..	..	26	27	28	29	30	31	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SEPTEMBER							MARCH							SEPTEMBER						
3	4	5	6	7	8	9	4	5	6	7	8	9	10	2	3	4	5	6	<b>7</b>	8
10	11	12	13	14	15	16	11	12	13	14	15	16	17	9	10	11	12	13	14	15
17	18	19	20	21	22	23	18	19	20	21	22	23	<b>24</b>	16	17	18	19	20	21	22
24	25	26	<b>27</b>	28	29	30	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	23	24	25	26	27	28	29
..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..
OCTOBER							APRIL							OCTOBER						
1	2	3	4	5	6	7	<b>1</b>	<b>2</b>	<b>3</b>	4	5	6	7	..	1	2	3	4	5	6
8	9	10	11	12	13	14	8	9	10	11	12	13	14	7	8	9	10	11	12	13
15	16	17	18	19	20	21	15	16	17	18	19	20	21	14	15	16	17	18	19	20
22	23	24	25	26	27	28	22	23	24	25	26	27	28	21	22	23	24	25	26	27
29	30	31	..	..	..	..	29	30	..	..	..	..	..	28	29	30	31	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
NOVEMBER							MAY							NOVEMBER						
..	..	..	1	2	3	4	..	..	1	2	3	4	5	..	..	..	..	1	2	3
5	<b>6</b>	<b>7</b>	8	9	10	<b>11</b>	6	7	8	9	10	11	12	4	5	6	7	8	9	10
12	13	14	15	16	17	18	13	14	15	16	17	18	19	11	12	13	14	15	16	17
19	20	21	22	23	24	25	20	21	22	23	24	25	26	18	19	20	21	22	23	24
26	27	28	29	<b>30</b>	..	..	27	28	29	<b>30</b>	31	..	..	25	26	27	28	29	30	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
DECEMBER							JUNE							DECEMBER						
..	..	..	..	..	1	2	..	..	..	..	1	2	..	..	..	..	..	..	1	2
3	4	5	6	7	8	9	3	4	5	6	7	8	9	2	3	4	5	6	7	8
10	11	12	13	14	15	16	10	11	12	13	14	15	16	9	10	11	12	13	14	15
17	18	19	20	<b>21</b>	<b>22</b>	<b>23</b>	17	18	19	<b>20</b>	21	22	23	16	17	18	19	20	21	22
<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	24	25	<b>26</b>	27	28	29	30	23	24	25	26	27	28	29
<b>31</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	30	31	..	..	..	..	..

# CALENDAR

1922-23

1922

September 25-October 7			Registration of graduate students
			Physical examinations for all students
September	27	Wednesday	Fall quarter begins, 8:30* a.m.
October	12	Thursday	Examinations in German and French for candidates for all advanced degrees
November	7	Tuesday	Election Day; a holiday
November	18	Saturday	Last day for filing subject of Master's thesis
November	30	Thursday	Thanksgiving Day; a holiday
December	20	Wednesday	Fall quarter ends, Christmas vacation begins, 5:20 p.m.

1923

January	4	Thursday	Christmas vacation ends, winter quarter begins, 8:30* a.m.
January	12	Friday	Examinations in French and German for candidates for all advanced degrees
February	12	Monday	Lincoln's Birthday; a holiday
February	22	Thursday	Washington's Birthday; a holiday
March	23	Friday	Winter quarter ends, spring vacation begins, 5:20 p.m.
April	4	Wednesday	Spring vacation ends, spring quarter begins, 8:30* a.m.
April	12	Thursday	Examinations in French and German for candidates
May	9	Wednesday	Last day for filing theses of candidates for all advanced degrees
May	26	Saturday	Last day for final written examinations for candidates for all advanced degrees
May	30	Wednesday	Memorial Day; a holiday
June	2	Saturday	Last day for oral examinations for candidates for all advanced degrees
June	9	Saturday	Last day for filing bond for publication of Doctor's thesis; last day for depositing binding fee for Master's thesis
June	17	Sunday	Baccalaureate service
June	19	Tuesday	Spring quarter closes, 5:20* p.m.
June	20	Wednesday	Fifty-first annual commencement
June	26	Tuesday	Summer Session and summer quarter begin.

\* First hour classes begin at 8:15 at University Farm.

## GRADUATE WORK IN MEDICINE

### ORGANIZATION

The graduate work in medicine in the Medical School and the Mayo Foundation is a part of the work of the Graduate School of the University. Its management is entrusted by the Board of Regents to a committee composed as follows:

The President of the University, LOTUS DELTA COFFMAN, Ph.D., LL.D.  
The Dean of the Graduate School, GUY STANTON FORD, Ph.D.  
The Dean of the Medical School, ELIAS POTTER LYON, Ph.D., M.D., D.Sc.  
The Director of the Mayo Foundation, LOUIS B. WILSON, M.D.  
CLARENCE MARTIN JACKSON, M.S., M.D., of the Medical School  
JENNINGS C. LITZENBERG, B.S., M.D., of the Medical School  
ARTHUR C. STRACHAUER, M.D., F.A.C.S., of the Medical School  
WILLIAM F. BRAASCH, B.S., M.D., of the Mayo Foundation  
MELVIN S. HENDERSON, M.D., of the Mayo Foundation  
LEONARD G. ROWNTREE, M.D., D.Sc., of the Mayo Foundation

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Public Health  
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ERNEST M. HAMMES, M.D., Assistant Professor of Mental and Nervous Diseases  
THOMAS B. HARTZELL, D.D.M., M.D., Research Professor of Mouth Infections  
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FREDERICK L. SMITH, M.D., Instructor in Surgery (Mayo Foundation)

HOWARD O. STEARNS, M.S., Instructor in Roentgenology and Radiology (Mayo Foundation)

CHARLES G. SUTHERLAND, M.B., Instructor in Roentgenology (Mayo Foundation)

THADDEUS L. SZLAPKA, B.S., M.D., Instructor in Medicine (Mayo Foundation)

PORTER P. VINSON, B.S., B.A., M.D., Instructor in Medicine (Mayo Foundation)

## GENERAL INFORMATION

The graduate work in medicine here outlined is not intended for those seeking brief practitioners' or review courses. Opportunities of this kind are to be found in the bulletin of the Medical School.

### HISTORY

In the fall of 1914, the University of Minnesota began graduate work in various fields of medicine and surgery in addition to that already offered for some time in the laboratory branches. The conditions laid down for this work as regards admission, residence, thesis, and examinations were those already applied by the Graduate School in approving all candidates for graduate degrees.

The training of medical graduates for special work in pathology, clinical medicine, and surgery by means of internships, residencies, and assistantships had been developed in the Mayo Clinic at Rochester, until in 1912 definite three-year services in these subjects for graduates in medicine, who had previously had one year's internship in a general hospital, were provided. These services were designated "fellowships," a term intended to cover internships, assistantships, residencies, etc. In order to perfect the organization and place the work on a permanent basis, February 9, 1915, a corporation, the Mayo Foundation for Medical Education and Research, was founded by William J. and Charles H. Mayo. On June 9, 1915, the University of Minnesota and the Mayo Foundation for Medical Education and Research entered into an agreement, by the terms of which the funds and income of the Mayo Foundation for Medical Education and Research are devoted, under the direction of the regents of the University of Minnesota, to the promotion of graduate work in medicine and to research in this field. On September 13, 1917, the funds and income of the Mayo Foundation were transferred entirely to the regents of the University.

### PURPOSE

In an age of specialization with the development of graduate work in all fields and phases of the sciences, letters, and arts, such educational work needs no elaborate justification. In a subject like medicine, intimately connected with established fields of research such as biology, chemistry, anatomy, physiology, pathology, and bacteriology the need for scientific research and for the training of scientific specialists, investigators, and teachers is as great as in any subject, and of as vital importance.

The possibilities of such work hitherto have suffered less from neglect than they have from the lack of organization, standardization, and certification by the educational institutions which have found it possible and advisable to put such applied subjects as agriculture, education, engineering, and commerce upon a scientific basis, and have freely recognized the accomplishments of trained students by the granting of higher earned degrees in these fields. In medicine in the United States, the leading specialists in

practice and the trained productive investigators have usually been developed by long years in internships, minor teaching positions, hospital residencies, or personal apprenticeships to other specialists. A few have obtained their special training in general practice, gradually narrowing to a particular field. Many men in both groups have broadened themselves by visits to other laboratories and clinics for observation and by longer or shorter periods of foreign study. A much larger body of clinical specialists of varying attainments have been developed by so-called postgraduate or polyclinic medical courses or by the simple and convenient method of self-proclamation.

Taken as a whole, by such undirected processes graduate students are apt to waste time on unessentials and to acquire very inadequate knowledge of many of the essentials. In clinical branches such processes fail to provide any sure protection to the public against the untrained specialist or to open any avenue to the public's confidence for the properly trained specialist. And medical education, if it is to advance, must at least be able to supplement a faculty of skilled practitioners with men trained to carry forward the frontiers of medical science.

The objects of this graduate work in medicine are accordingly the training for medical practice of fully equipped and properly certified specialists and of investigators and teachers of medicine.

#### STANDARDS

In graduate work in medicine the University of Minnesota, in order to secure results and safeguard scientific standards, adopted those general policies and methods already indicated by the established graduate work in other sciences. The development has depended upon the maintenance of real standards of admission, the supply of qualified advisers to graduate students, the provision of adequate laboratory, clinical, and library equipment, and the institution of rigid tests in course and examinations in residence, with evidence of the power of productive research on the part of the student as evidenced in a thesis.

In doing this work the University of Minnesota is not seeking to multiply the opportunities for securing simply technical training through practitioners' courses. The graduate work is definitely intended to provide opportunities in three years of work for the well-prepared serious-minded student to fit himself in the science, as well as in the art, of some special field of medicine or surgery. Entrance upon the work and continuance in it, as well as the holding of scholarships or fellowships in the Medical School or on the Mayo Foundation, will be strictly conditioned upon evidences of power and growth along scientific lines. The value of technical or mechanical skill as a practitioner or operator has its place, but will be subordinated to, and measured by, the power and product of the brain that guides the hand. From the standpoint of both the University and the prospective student it is highly important that this distinction in purpose be kept clearly in mind.

By the present arrangement of courses in arts, science, and medicine a properly prepared student may enter the University, and in seven years secure the usual doctorate degree in arts, in science, or in medicine. The



object of the plan pursued at this University since 1914 is to provide three years of additional work on the basis of the degree of doctor of medicine, and leading to the special degree of master of science (M.S.) or doctor of philosophy (Ph.D.) in medicine, in surgery, in pathology, etc.

In clinical branches the degree of master of science is intended primarily to indicate scientific proficiency. To be recommended for this degree the candidate must have given evidence by two or three years of residence that he is competent to begin the practice of a clinical specialty in a scientific manner without the supervision of others. The doctorate of philosophy in clinical subjects will be given only to those men who have given evidence not only of proficiency at least equal to that required for the Master's degree, but who in addition present evidence of well-marked ability to advance medical science.

#### WORK IN PUBLIC HEALTH

By the choice of appropriate studies students may prepare themselves to follow various careers in public health work. Graduate students with the proper qualification may prepare themselves to serve as specialists in certain fields of public health work or they may procure a thoro general training with a certain amount of practical experience in public health.

A special circular on public health nursing will be sent on request to the registrar.

Such undergraduate and graduate students as satisfactorily fulfill the requirements of the University will be granted appropriate degrees.

Further inquiries concerning the above mentioned courses and curricula should be addressed to Dr. H. S. Diehl, Millard Hall, University of Minnesota.

#### LABORATORY EQUIPMENT

The laboratory equipment for the prosecution of graduate work in medicine is located in Minneapolis, St. Paul, Rochester, and Pokegama.

The laboratory branches are well housed in excellently equipped buildings on the campus at Minneapolis and at Rochester. Anatomy, chemistry, pathology, and bacteriology are in modern University buildings especially designed for them. Physiology, physiologic chemistry, and pharmacology are located in Millard Hall, a modern building of the best type. The laboratories for experimental medicine and surgery and extensive animal quarters are also in this building. The University museums of anatomy, pathology, and surgery contain a large number of specimens available for teaching purposes.

In Rochester, the laboratories of general pathology, pathologic anatomy, clinical pathology and bacteriology, experimental bacteriology, physiologic chemistry, experimental pathology and physiology, roentgenology, photography are in the Mayo Clinic Building, as is also the pathologic working museum, which contains over 125,000 specimens.

Laboratories of surgical pathology are at St. Mary's, Colonial, Worrell, and Kahler hospitals. The metabolic laboratory is at the Kahler Hospital. Electrocardiographic laboratories are maintained in the Clinic Building and

in the Kahler Hospital. A laboratory of physiologic chemistry is at St. Mary's Hospital. A farm for experimental animals is maintained outside the city.

#### CLINICAL EQUIPMENT

The University owns and controls Elliot Memorial Hospital with its service building. This provides a clinic of 200 beds, and has the accumulated hospital records of ten years. The Out-Patient Department of the hospital is housed in Millard Hall and received 15,398 new patients and 69,135 patients' visits during the year ending June 30, 1921.

The State Hospital for the Crippled and Deformed at Phalen Park, St. Paul, offers the University full participation in its clinical opportunities.

The city hospitals of Minneapolis and the City and County Hospital of St. Paul, representing in all some 1,400 beds, exhibit every phase of clinical service in their wards and amphitheatres. This material, and also that of the new Miller Hospital, St. Paul, is available for graduate work.

In Rochester, St. Mary's, Colonial, Worrell, Stanley, Curie, Olmsted, Alfred, and Kahler hospitals and the Damon Sanitarium have an aggregate of about 1,500 beds with twelve operating rooms for general surgery and six for diseases of the organs of the special senses. All patients are examined clinically in the Mayo Clinic Building and its annexes. In 1921, 52,217 patients were examined. In addition more than 460,000 clinical histories are on file and available for investigative studies. During 1921, 22,016 operations were performed.

Consent for post-mortems is obtained with about 85 per cent of patients dying in the clinic.

The working museum contains more than 150,000 pathologic specimens. All case histories and specimens are classified and arranged so as to be readily available for scientific research.

Arrangements have been made whereby fellows or other graduate students in medicine may divide their time, part of their work being taken in the Mayo Foundation at Rochester, and part in the Medical School at Minneapolis and St. Paul.

#### LIBRARIES

Besides the University Library and the departmental libraries, there are at the disposal of the student the general medical libraries in Millard Hall and the Mayo Clinic Building, and the collections of the Hennepin County and Ramsey County Medical Societies. Current issues and complete files of most important medical periodicals are available either in Minneapolis or Rochester.

#### METHODS OF STUDY

Every attempt is being made to establish the graduate work in medicine on a true University basis. Little class work is done. No short cramming courses are offered. The Mayo Foundation lectures at Rochester and frequent special lectures at the Medical School, are given by men who are enthusiastically interested in their particular topics, but each lecturer presumes that his hearers are already well grounded in the fundamentals of

his subject. Attendance at these lectures is purely optional with the graduate student. No quizzes are held and no examinations are given on these lectures. The same is true of the clinical and laboratory demonstrations and departmental seminars. Everything is done to impress the graduate student that his residence is an opportunity for him to find out things for himself and not a period in which he will be instructed by undergraduate methods. The student's work is carefully graded by his immediate chief, whose duty it is to determine the student's ability by daily intercourse with a smaller number of students rather than by class quizzes and formal examinations. Students holding fellowships who do not evince strong personal initiative will not be recommended for annual reappointment, or may be asked to resign their fellowships before the end of their period of appointment. In the arrangement of work the best opportunities will be consistently given to the best qualified men. Low-grade and mediocre men will not be permitted to continue to fill appointments to the exclusion of high-grade men. Work which receives a grade below B will not be counted for graduate credit in the major field, nor if below C in the minor.

#### REGISTRATION AND NUMBER OF STUDENTS

All students entering upon graduate work in medicine will register with the dean of the Graduate School. Students who begin their residence work in Rochester may fulfill the preliminary requirements by registering there with the director of the Mayo Foundation.

The number of graduate students who will be registered for work is determined by the clinical opportunities. This limitation applies to those doing their major work in clinical medicine and surgery and not to those majoring in the laboratory departments.

#### TUITION

The tuition fee for the graduate work in clinical medicine and surgery is \$30 per quarter. For students in the fundamental laboratory branches, the tuition fee is \$10 per quarter. Extra fees may be charged to cover the cost of materials and supplies for exceptional laboratory experimentation. The fees for graduate work in the Summer Session are stated in the special Summer Session bulletin. Fellows, scholars, and members of the teaching or scientific staff are exempt from tuition.

#### FELLOWSHIPS AND SCHOLARSHIPS

Teaching fellowships in the Medical School are now established as follows: in surgery, 2; in internal medicine, 2; in obstetrics, 2; in ophthalmology and oto-laryngology, 2; in mental and nervous diseases, 2; and in pediatrics, 3. These include fellowships in the Minneapolis General Hospital. Three fellowships are also available in the University Health Service. They carry a stipend of \$600 the first year, \$750 the second, and \$1,000 the third. These teaching fellows are required to devote their entire time (excepting an annual vacation of three weeks) to graduate work, including a small amount of teaching.

Similar teaching fellowships have been established in the fundamental laboratory department of the Medical School as follows: in anatomy (including histology and embryology), 3; in physiology and physiologic chemistry, 1; in pathology, 1; in pharmacology, 1. These fellowships carry a stipend of \$900 the first year, \$1,200 the second, and \$1,500 the third year. They require a small amount of teaching, the remainder of the time being devoted to graduate work leading to advanced degrees.

In addition, there are at Minneapolis 5 scholarships, without stipend, carrying free tuition with opportunity for graduate study in any of the clinical departments.

The attention of prospective medical graduate students is also called to the Shevlin Fellowship in medicine yielding \$500 and tuition. Applications should be in the hands of the dean of the Graduate School before March 1.

The Mayo Foundation carries the following fellowships: in clinical and experimental surgery, 63; in orthopedic surgery, 6; in ophthalmology, 4; in rhinology and oto-laryngology, 8; in dental surgery, 6; in clinical and experimental medicine, 45; in neurology, 2; in dermatology, 4; in urology, 6; in roentgenology, 4; in pathology, 4; in bacteriology, 2; in chemistry, 2. The fellowships in clinical branches pay \$600 the first year, \$750 the second year, and \$1,000 the third year. The fellowships in pre-clinical branches pay \$900 the first year, \$1,200 the second year, and \$1,500 the third year. They require full time with an annual vacation of two weeks. During residence in a hospital \$25 per month is deducted from the stipend for board and room.

Nominations for fellowships on the Mayo Foundation are made each quarter, beginning with July 1, for residence to begin six months later or as vacancies occur. In the Medical School appointments are made as vacancies occur.

The Miller Hospital Clinic, St. Paul, supports four clinical fellowships, one each in surgery, medicine, ophthalmology and oto-laryngology, and obstetrics and gynecology. Appointments are made as vacancies occur. Apply through the Graduate School.

All appointments are made for one year and are renewable annually for a period of three years upon the basis of satisfactory progress in the work pursued. Requests for blanks for application for fellowships and scholarships should be addressed to the dean of the Graduate School, University of Minnesota, Minneapolis, Minnesota, or to the director of the Mayo Foundation, Rochester, Minnesota.

#### ASSISTANTSHIPS

A few qualified assistants, such as traveling fellows from other universities, officers of the medical corps of the United States Army, Navy, or Public Health Service, et al, designated as special students and not candidates for degrees may be accepted at Rochester in laboratory and clinical branches for short periods. The number is necessarily limited in order not to interfere with the work of the resident fellows. Correspondence concerning this work should be directed to the director of the Mayo Foundation, Rochester, Minnesota.



Several of the departments in the Medical School (including Anatomy, Physiology, and Pathology) have paid assistantships which may furnish means of self-support while the holder is pursuing graduate work. For further information, address the dean of the Medical School.

#### CLINICAL AND CLASS WORK FOR VISITING OR RESIDENT PRACTITIONERS

In order that there may be no misunderstanding, it should be stated that the graduate work for a limited number, described above, in no way changes or modifies the opportunities for observation hitherto extended visiting physicians and surgeons by the Mayo Clinic in Rochester, or the arrangements offered in Minneapolis by the Medical School for practitioners who wish to attend such undergraduate medical classes as may be of profit to them without interfering with the regular work of the staff and students of the Medical School. Inquiries concerning these opportunities should be addressed to the dean of the Medical School, Millard Hall, Minneapolis, Minnesota.

#### SUMMARY OF REQUIREMENTS

The various steps involved in the requirements for the degree of doctor of philosophy (Ph.D.) in any one of the clinical or laboratory departments are briefly summarized on pages 22 and 23. The requirements for the Master's degree (M.A. or M.S.) are also indicated. Further information concerning graduate work in general may be found in the general Graduate School bulletin.

#### REQUIREMENTS FOR ADVANCED DEGREES IN MEDICINE

1. *Selection.*—In the selection of graduate medical students, and in making appointments to fellowships for medical graduate work, preference will be given, other things being equal, to students who have an unusually good training in the fundamental medical sciences (i.e., anatomy, physiology, pathology, etc.) through which they should make their approach to the specialty which they wish to take as a major subject.

2. *Admission.*—All graduate students are admitted by the dean of the Graduate School. Entrance upon work for the advanced degrees of master of science (M.S.) or doctor of philosophy (Ph.D.) in the clinical departments of medicine is limited to those who have: (a) the Bachelor's degree in arts or science, or its equivalent;\* (b) the degree of doctor of medicine from acceptable institutions (i.e., those in Class A of the American Medical Association); and (c) one year's experience as an intern in an approved hospital or as an assistant in a laboratory in an acceptable medical school. In the fundamental laboratory sciences (anatomy, physiology, bacteriology, pathology, and pharmacology) properly prepared students may be admitted without (b) and (c) as candidates for the Master's degree (M.A. or M.S.) or the Doctor's degree (Ph.D.).

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\* Students who have completed at least two years of pre-medical collegiate work, making an equivalent of the seven years combined Arts-Medicine Course at the University of Minnesota, are eligible for admission as graduate students.



Upon entrance to the Graduate School, the candidate, with the approval of the dean, will select his adviser in the field of his major work. With the approval of his adviser and the dean, he will outline a study program for the year, and if possible for the period of residence.

The study program for the entire three years must be submitted at the beginning of the second year. This program requires approval by the student's adviser, by the dean, and by the Medical Group Committee.

3. *Residence*.—For the Doctor's degree (Ph.D.) at least three full years of successful graduate study are required, including certain special requirements noted below. For the Master's degree (M.S.) in clinical subjects, two or three years are required. For the Master's degree in the laboratory sciences a minimum of one year of residence is required.

4. *Language requirements*.—A reading knowledge of French and German in the field of the candidate's major must be certified by the professors in charge of these languages at least one year before the Doctor's degree is conferred, and before admission to the preliminary examination. The candidate's adviser or his representative is expected to attend this examination and to furnish appropriate literature for the test. For the Master's degree in the laboratory sciences, a reading knowledge of one foreign language is also required, which must be certified before the end of the second quarter of the year in which the candidate expects to present himself for the degree. For the Master's degree (M.S.) in the clinical branches, the language certificate is optional.

5. *Minor*.—With the approval of his adviser and the dean of the Graduate School, each student upon entrance selects a minor, which must be logically related to his major subject, and (for the Doctor's degree) must be completed by the end of the second year. The minor is preferably a laboratory subject in some other department, and should amount to not less than one sixth of the total work for the degree. At least one sixth of the work offered for the degree in a clinical subject should consist of graduate work in the fundamental laboratory branches, which will serve as a basis for the proposed clinical specialization. This fundamental work should be concentrated in the first part of the course so far as possible. The final examination in the minor for the Doctor's degree is included in the preliminary examination, as noted below. For the Master's degree no special examination is required in the minor, aside from the usual course examinations.

6. *Major*.—The major is that department in which the student desires to specialize. Together with the thesis, it should occupy at least two thirds of the total work for the degree. At least one year before attaining the Doctor's degree, the following procedure is required in order that the candidate may become eligible for the preliminary examination. In addition to the completion of the minor work and of the language requirement, he must have the written approval of the department committee (which includes the graduate faculty members) of the major subject. The statement of the department committee should include the subject of the special problem for the thesis, and should certify as to the ability of the candidate to

meet all requirements for the degree sought. It should be based on the quality of the candidate's daily work in residence.

7. *Admission to candidacy.*—For the Master's degree, students who have met the language requirement, whose daily work in residence as indicated by quarterly grades has been satisfactory, and whose thesis subject has been properly approved, are admitted to candidacy at the end of the second quarter by vote of the Executive Committee of the Graduate School. For the Doctor's degree, the student is required to pass a preliminary examination, as noted below, before admission to candidacy.

8. *Preliminary examination.*—At least one calendar year before the Doctor's degree is conferred, a preliminary examination of the student shall be given by a committee appointed by the dean and including the student's adviser as chairman, a representative of the Medical Graduate Committee (other than the adviser), the head of his major department, a representative of the minor, and such additional members as the dean may consider necessary. Certificates of proficiency in French and German, completion of the minor work, and the recommendation of the major department shall be required before admission to this examination. The examination is in addition to the usual course examinations. It shall cover the graduate work previously taken by the student, *and may include any work fundamental thereto.* The field of the candidate's specialization and the thesis are reserved for the final examination. The examination is both oral and written, the latter being arranged by faculty representatives from both Minneapolis and Rochester. Only after the successful completion of this examination may the student be enrolled as a candidate for the Doctor's degree. Students failing to pass this preliminary examination shall not be reexamined until at least one quarter has passed.

9. *Thesis.*—Each candidate for an advanced degree (Master's or Doctor's) must submit a thesis. For the Master's degree, the subject of the thesis should be filed with the dean of the Graduate School by November 15. The subject must be approved by the adviser and by the Medical Graduate Committee. The topic should be within the field of the major, and the thesis should represent approximately half of a year's work of the student. The thesis must be written in acceptable English. It must show ability to work independently and give evidence of power of independent thought both in perceiving problems and in making satisfactory progress toward their solution. Familiarity with the bibliography of the special field and correct citation of authorities are expected.

The Master's thesis must be typewritten in triplicate, one copy on a special form of linen stock, the other two as carbon copies. Samples of the paper required should be examined in the dean's office. The three copies of the thesis must be filed in the dean's office not later than six weeks before graduation. The thesis will be examined by a committee appointed by the dean, on recommendation of the Medical Graduate Committee. Unanimous approval by the thesis committee is necessary for the acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the reg-

istrar, at least one week before commencement, the sum of one dollar for binding one copy of the thesis, which will be cataloged and deposited in the University Library.

For the Doctor's degree, a more elaborate thesis is required. The subject is to be stated in the written department recommendation, which precedes the preliminary examination at the end of the second year. The accumulation of material for the thesis should be started much earlier. The thesis must give evidence of originality and power of independent investigation. It must embody results of research forming a real contribution to knowledge and must exhibit a mastery of the literature of the subject and a familiarity with the sources of knowledge. The matter must be presented with a fair degree of literary skill. The kind of work required in theses for advanced degrees in medicine is exemplified in the volume, *Papers from the Mayo Foundation and the Medical School*, published by W. B. Saunders Company, Philadelphia, 1921.

The thesis must be typewritten in triplicate, to facilitate reading by the thesis committee. The three copies must be filed in the dean's office not later than six weeks before graduation together with a summary or abstract. The dean will appoint a thesis committee with the student's adviser as chairman. Unanimous approval by this committee will be necessary for the acceptance of the thesis. If the thesis is accepted, the candidate must deposit with the registrar, not later than one week before commencement, a sufficient bond to cover the costs of printing as laid down in the regulations adopted June 12, 1922. A copy will be furnished on request.

10. *Final written examination.*—In addition to the usual course examinations in all subjects where such are given, the candidate for the Master's degree must pass a final written examination in the field of the major. (No special final examination is required in the minor.) The final written examination will be held not later than four weeks before commencement. It is given by the members of the graduate faculty in the major department, the adviser acting as chairman. This examination shall cover all the work done in the major, and may include any work fundamental thereto.

For the Doctor's degree, a final written examination in the major subject is similarly given, after the thesis is presented and at least four weeks before commencement.

11. *Final oral examination.*—If all other requirements for the degree have been met, including the final written examination and the acceptance of the thesis, the final oral examination will be held not less than two weeks before commencement.

For the Master's degree, the adviser will act as chairman of the examining committee, which will include all the instructors with whom the student has taken work, the thesis committee, and ex-officio, the head or chairman of the department in which the major work is done. Any member of the graduate faculty may attend as a visitor, and written notice shall be sent by the chairman of the committee to all members of the graduate faculty in the major and minor departments. The final oral examination will cover all the work offered for the degree, and may include other work fundamental thereto. All final examinations for the higher degrees in medicine

will include questions on the history of medicine with special reference to the candidate's major field. At the close of the examination, the committee will vote upon the candidate, taking into account all of his work. A majority vote is required for approval.

For the Doctor's degree, the committee conducting the final oral examination will consist of the adviser as chairman, of a majority of the members of the graduate faculty in the major department, and of at least three other members of the graduate faculty appointed by the dean. At least one member of this committee shall be from a group other than the one in which the major department is included. This examination is to cover the special field of knowledge represented by the major work, including the thesis problem, and shall not exceed three hours. The date of the final oral examination for the doctorate shall be publicly announced, and the examination shall be open to any member of the graduate faculty. Upon completion of the examination, a formal vote of the committee shall be taken and an affirmative vote of at least two thirds of the members shall be necessary for recommendation of the candidate for the degree.

12. *Recommendation by the faculty.*—The dean will report to the graduate faculty the names of those who have completed the requirements for the Master's and Doctor's degrees, and those duly approved will be recommended by the faculty to the Board of Regents of the University. Unless excused by the dean of the Graduate School and the president of the University, all candidates are required to be present at commencement when the degrees are conferred.

#### TABULAR SUMMARY OF REQUIREMENTS FOR THE MASTER'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
Program, major and minor	Adviser and dean of the Graduate School .....	On entrance.
Approval of thesis subject	Adviser and group committee....	November 15.
Language requirement...	Adviser and language department..	Before close of second quarter.
Approval of candidacy...	Executive committee.....	Beginning of third quarter.
Filing of thesis.....	Dean of the Graduate School....	Six weeks before graduation.
Examination of thesis...	Thesis committee .....	Before admission to final oral examination.
Final written examination in major.....	Major department members of the graduate faculty .....	Not later than four weeks before commencement and before final oral.
Final oral examination on all work.....	Thesis committee; all instructors; head of major department....	Not later than two weeks before commencement.

(Course examinations as required at the usual time.)

Fee for binding thesis... Registrar .....

One week before commencement.

(For the Master's degree in clinical subjects, the dates refer to the last year.)

TABULAR SUMMARY OF REQUIREMENTS  
FOR THE DOCTOR'S DEGREE

WORK	UNDER THE DIRECTION OF	DATE
<b>FIRST YEAR</b>		
Major .....	Adviser and dean of Graduate	
Minor .....	School .....	
<b>SECOND YEAR</b>		
Tentative program of entire second and third years' work...	Adviser, Medical Graduate Committee, and dean of Graduate School .....	Before beginning work of second year.
Major, including thesis	As for tentative program.....	
Minor .....	Adviser and minor department...	Before admission to preliminary examination.
Language .....	Adviser and language department..	One calendar year before degree is to be conferred.
Recommendation .....	By major department.....	
Preliminary examination .....	Special committee.....	
<b>THIRD YEAR</b>		
Major, including thesis	Adviser, Medical Graduate Committee, and dean of Graduate School .....	
Filing of thesis.....	Dean .....	Six weeks before graduation.
Approval of thesis....	Thesis committee .....	Before admission to final oral examination
Final written examination in major.....	Major department members of the graduate faculty .....	Four weeks before commencement and before final oral examination.
Final oral examination	Adviser, majority of members of major department, and other members appointed by dean of Graduate School .....	Not later than two weeks before commencement.
Bond for publication of thesis .....	Registrar .....	Not later than one week before commencement.



## DESCRIPTION OF COURSES

The members of the faculty at Rochester (Mayo Foundation) are indicated by an asterisk (\*) in the list at the head of each departmental statement. The courses given at Rochester are grouped separately, and the numbers given the special prefix "M." The suffixed f, w, s, and su indicate fall, winter, spring, and summer quarters, respectively. The hyphen denotes courses continuous through the quarters indicated. Suffixed letters separated by commas indicate the repetition of the course in the corresponding quarters. The courses numbered between 100 and 200 are less advanced in character, and in some cases are open as electives to properly qualified undergraduates. The courses above 200 are primarily graduate in character, of the more advanced or research type.

The various divisions are grouped under the following departments:

1. Anatomy (including histology and embryology)
2. Bacteriology and Immunology
3. Medicine (including general medicine, dermatology, and mental and nervous diseases)
4. Obstetrics and Gynecology
5. Ophthalmology and Oto-Laryngology
6. Pathology
7. Pediatrics
8. Pharmacology and Therapeutics
9. Physiology and Physiologic Chemistry
10. Roentgenology
11. Surgery (including general surgery, experimental surgery, orthopedic surgery, urology, and dental surgery)

### ANATOMY

Professors CLARENCE M. JACKSON, JOHN B. JOHNSTON, THOMAS G. LEE, RICHARD E. SCAMMON; Associate Professor ANDREW T. RASMUSSEN.

The Institute of Anatomy offers excellent facilities to students who wish to take advanced work or to pursue investigations in anatomy.

The prerequisite work for all students who desire a major or minor in the Department of Anatomy includes general zoology (animal biology), 6 semester hours, and advanced zoology or elementary courses in anatomy (including histology, embryology, and neurology), 6 semester hours. In addition, each student who desires a major in anatomy must have had the elementary courses in that branch of anatomy in which he desires to specialize—gross anatomy, histology, embryology, or neurology. Students majoring in clinical subjects who desire a minor in anatomy must have had the courses in anatomy usually required of medical students (including Courses 103, 107, and 111). A reading knowledge of either French or German is required of students who desire a major in anatomy for the Master's degree, and a reading knowledge of both French and German is required of those who are candidates for the Doctor's degree.

## COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

- 103s,su. HUMAN HISTOLOGY. A microscopic study of the various tissues and organs. Prerequisites: Anatomy 5-6, or equivalent. Nine credits. MR. SCAMMON.
- 107s,su. HUMAN EMBRYOLOGY. The development of the human body. Prerequisites: Anatomy 5-6, or equivalent. Six credits. MR. SCAMMON.
- 111f,su. HUMAN NEUROLOGY. A study of the gross and microscopic structure of the central nervous system and sense organs of man. Prerequisites: Anatomy 103 and 107, or Animal Biology 9-10. Six credits. MR. RASMUSSEN.
- 112f,w,s. COMPARATIVE NEUROLOGY OF VERTEBRATES. Prerequisites: Anatomy 111, or Animal Biology 27. MR. JOHNSTON.
- 121f,s. ANATOMICAL TECHNIQUE. Lectures and laboratory work upon the principles and practice of microtechnique. Prerequisites: Anatomy 103, or Animal Biology 9-10. Three credits. DR. LEE.
- 129f-130w-131s. TOPOGRAPHIC ANATOMY. Based upon a study of cross sections of the human body. Lectures and laboratory work. Prerequisites: Anatomy 5-6-7. Two credits (or more) each quarter. DR. JACKSON.
- 133f,su. ANATOMY OF THE FETUS AND CHILD. A survey of prenatal and postnatal development. Fourth-, fifth-, or sixth-year medical, or graduate students. Limited to sixteen students. Prerequisites: Courses 5-6-7, 107. Three credits. MR. SCAMMON.
- 134w. ANATOMY OF THE NEW-BORN. A detailed laboratory study of the anatomy of the new-born. Fourth-, fifth-, or sixth-year medical, or graduate students. Prerequisites: Course 133, or equivalent. Three credits. MR. SCAMMON.
- 135f,su. PHYSICAL DEVELOPMENT OF CHILDHOOD. Lectures, with study of illustrative material. Primarily for students in the College of Education; open to medical or graduate students by permission of instructor. Two credits. MR. SCAMMON.
- 137f-138w-139s-140su. IMPLANTATION AND PLACENTATION. A study of the implantation of the ovum, the formation of the placenta, and the earliest stages of development in man and mammals. Prerequisites: Anatomy 102 or equivalent. Three credits (or less). DR. LEE.
- 149w. EXPERIMENTAL NEUROLOGY. A study of the morphology of the central nervous system by experimental methods. Prerequisites: Course 111. Three credits (or more). MR. RASMUSSEN.
- 153f-154w-155s-156su. ADVANCED ANATOMY. Individual topics for advanced work in gross anatomy, histology, embryology, or neurology will be assigned to students who have completed the elementary courses in

the corresponding subjects. Special courses are arranged for clinical graduate students. DR. JACKSON, MR. JOHNSTON, DR. LEE, MR. SCAMMON, MR. RASMUSSEN.

157f. HISTOLOGY AND EMBRYOLOGY OF THE EYE, EAR, NOSE, AND THROAT. Three credits. MR. SCAMMON.

160f-162w-163su. SEMINAR IN GROWTH OF CHILDREN. A study with graphic analysis of data on physical development of children of school age. Prerequisites: Course 135, or equivalent. Hours and credits to be arranged. MR. SCAMMON.

#### COURSES PRIMARILY FOR GRADUATE STUDENTS

201f-202w-203s-204su. RESEARCH IN ANATOMY. Qualified students may undertake the investigation of problems in anatomy, including histology, embryology, and neurology. Special facilities are offered to graduate students in the clinical departments for work upon problems in applied anatomy. DR. JACKSON, MR. JOHNSTON, DR. LEE, MR. SCAMMON, MR. RASMUSSEN.

205f-206w-207s. ANATOMICAL SEMINAR. Reviews of the current literature and discussion of research work being carried on in the department. Reading knowledge of French and German required. DR. JACKSON.

#### BACTERIOLOGY AND IMMUNOLOGY

Professors WINFORD P. LARSON, EDWARD C. ROSENOW;\* Associate Professors ARTHUR T. HENRICI, ARTHUR H. SANFORD.\*

##### A. COURSES OFFERED AT MINNEAPOLIS

101f,su. SPECIAL BACTERIOLOGY FOR MEDICAL STUDENTS. The study of pathogenic bacteria, especially in relation to definite diseases; bacteriological methods in clinical diagnosis; principles of infection and immunity, with practical application of serum reactions. Fourth-year medical students and others. Prerequisite: general bacteriology. Sixty-six hours; 4 credits. DR. LARSON and assistants.

105f. HOUSEHOLD BACTERIOLOGY. The decay, fermentation, and putrefaction of foodstuffs; molds; canning; bacterial food-poisoning; bacteriology of the cleansing processes. Prerequisite: general bacteriology. Forty-four hours; 3 credits. MISS BENTON.

114s. THE HIGHER BACTERIA. Study of morphology, cultivation, and classification of actinomycetes, yeasts, and molds. Study of the mycoses. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. DR. HENRICI.

116w. COURSE IN IMMUNITY. Laws of hemolysis. Quantitative relationship between antigen and antibody. Wasserman reaction. Opsonins. Vaccines. Precipitin reaction. Blood grouping. Abderhalden reaction. Anaphylaxis. Fifth- and sixth-year medical students. Limited to ten students. Forty-four hours; 3 credits. DR. LARSON.

- 117s. PATHOGENIC PROTOZOA. Study of parasitic Protozoa in men, including spirochaets; their morphology and life histories; intermediate hosts as agents in the spread of disease; cultural methods. Prerequisites: general and special bacteriology; Animal Biology 45 and 107. Forty-four hours; 3 credits. DR. LARSON.
- 118f. MORPHOLOGY AND TAXONOMY OF BACTERIA. Cytology of bacteria; their origin and systematic position; consideration of morphological, biochemical, and immunological characters as data for classification; variations and mutations in bacteria; the biometrical method as applied to bacteriology. Prerequisites: general and special bacteriology. Forty-four hours; 3 credits. DR. HENRICI.
- 119f. BACTERIOLOGICAL CHEMISTRY. Chemical analyses of bacteria; physical agents influencing bacterial metabolism (salinity, hydrogen-ion concentration, surface tension, etc.); factors stimulating enzyme production; protein, carbohydrate, and fat metabolism of bacteria; nitrogen fixation. Prerequisites: general and special bacteriology; physiologic chemistry or phytochemistry. Sixty-six hours; 4 credits.
- 120w. CONTINUATION OF 119f. Bacterial toxins; "split proteins"; bacterial activity in the alimentary tract; pigment production; autolysis of bacteria; immunochemistry; permeability of bacterial cells; behavior of bacteria toward electricity. Sixty-six hours; 4 credits.
- 150f-151w (or 150w-151s). ADVANCED BACTERIOLOGY. An advanced course giving additional work in bacteriology and the opportunity of working out special problems. Limited to ten students. Forty-four hours; 3 credits. DR. LARSON, DR. HENRICI.
201. RESEARCH IN BACTERIOLOGY. Graduate students of the necessary preliminary training may elect research, either as majors or minors, in bacteriology. Hours and credits arranged. DR. LARSON, DR. HENRICI.
203. SEMINAR IN BACTERIOLOGY. One credit.

## MEDICINE

(Including General Medicine, Dermatology and Nervous and Mental Diseases)

Professors ARTHUR S. HAMILTON, THOMAS B. HARTZELL, HENRY S. PLUMMER,\* LEONARD G. ROWNTREE,\* WALTER D. SHelden,\* JOHN H. STOKES,\* S. MARK WHITE; Associate Professors GEORGE B. EUSTERMAN,\* HERBERT Z. GIFFIN,\* NORMAN M. KEITH,\* WILLIS S. LEMON,\* ARCHIBALD H. LOGAN,\* ROBERT D. MUSSEY,\* ARTHUR H. SANFORD,\* JOHN P. SCHNEIDER, HENRY L. ULRICH; Assistant Professors DAVID M. BERKMAN,\* WALTER M. BOOTHBY,\* GEORGE E. FAHR, FRED W. GAARDE,\* DORR F. HALLENBECK,\* J. CHARNLEY MCKINLEY, JAY A. MYERS, WILLIAM A. PLUMMER,\* ERNEST T. F. RICHARDS, LEDA J.

STACY,\* RUSSELL M. WILDER,\* FREDERICK A. WILLIUS,\* HENRY W. WOLTMANN,\* INSTRUCTORS MAURICE B. BONTA,\* GEORGE E. BROWN, LOUIS A. BUIE,\* HARRY M. CONNER,\* HOWARD R. HARTMAN,\* WILLIAM H. LONG,\* CHARLES S. McVICAR,\* PAUL A. O'LEARY,\* MONTE C. PIPER,\* LEE W. POLLOCK,\* IRENE SANDIFORD,\* THADDEUS L. SZLAPKA.\*

The graduate work in the Department of Medicine is designed to prepare students for practice of the specialty of internal medicine, research in the problems of general medicine, and for the specialty of nervous and mental diseases, as the case may be, and to train men as teachers in their respective fields. Prospective students who have had no special work in addition to that of the undergraduate course in physiology, physiologic chemistry, therapeutics, experimental medicine, or pathology are advised to devote a year or more to these subjects before entering the regular three-year graduate courses. It is recommended that a minor be carried throughout the course in one or more of the following departments: Physiology, Pharmacology, Pathology, and Immunology. For students specializing in nervous and mental diseases, minors in anatomy and psychology are especially valuable, and for those desiring it, work could be arranged in the Department of Ophthalmology and Oto-Laryngology, giving a special opportunity to study lesions of the eye occurring in systemic disorders. In the Medical School, during at least the third year of the three-year fellowship, the fellow acts as an officer of the clinic with definite responsibility in the care of patients in the University Hospital.

#### A. COURSES OFFERED AT MINNEAPOLIS

- 201f,w,s,su. CLINICAL MEDICINE. Study of general diagnosis and methods of investigation and recording clinical data. The laboratory of experimental medicine is open for study of special problems arising in the investigation of cases. Emphasis placed on methods of treatment. DR. WHITE, DR. SCHNEIDER, DR. FAHR, DR. RICHARDS.
- 202f,w,s,su. DISEASES OF CARDIOVASCULAR APPARATUS. Special study of diseases of the heart and blood vessels, including technique and application of the polygraphs, electrocardiograph, and interpretation of outlines of the heart and great vessels obtained by means of the radiograms and orthodiagram. DR. WHITE, DR. FAHR.
- 203f,w,s,su. RESEARCH IN MEDICINE. University Hospital and Out-Patient Department. DR. WHITE, DR. SCHNEIDER, DR. FAHR, DR. RICHARDS.
- 204f,w,s,su. PROBLEMS IN MEDICINE. Specific problems in diagnosis and treatment, including problems in immunology viewed from the clinical standpoint. General Hospital. DR. ULRICH.
- 205f,w,s,su. TUBERCULOSIS. Special opportunities in the study of problems relating to tuberculosis are afforded. Coöperation between the Medical School and various sanatoria specializing in tuberculosis is close, and problems may be studied, both the clinical and laboratory sides. An Out-Patient Department with rich material is available. DR. MYERS.



- 206f,w,s,su. RESEARCH IN MOUTH INFECTIONS. A study of dental and paradental infections as related to systemic disease. Experimental study to determine the lesion produced in animals by bacteria from these sources. DR. HARTZELL.
- 207f,w,s. PATHOLOGY OF THE NERVOUS SYSTEM. The preparation of gross and microscopic material from diseased nerve tissues; the relations existing between pathologic lesions, signs, and symptoms; the chief neuron systems and principles underlying their degeneration. DR. HAMILTON.
- 208f,w,s,su. CLINICAL NEUROLOGY. Advanced diagnosis of nervous diseases; practical experience in diagnostic procedures employed in the study of diseases of the nervous system. DR. HAMILTON.
- 209f,w,s,su. NEUROLOGIC RESEARCH. DR. HAMILTON.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The work in internal medicine at Rochester consists of history-taking, physical examinations, the recommendation of patients for special examinations with correlation of results thereof, and the formation of independent judgments concerning diagnoses, and indications and recommendations for medical and surgical treatment, all under the immediate direction of the chief of the section and his associate or his first assistant. Each service consists of six days each week for one year (except as noted) in a clinical section. A seminar is held at least once a week in each section for the discussion of the group of cases to which special attention is given in the section. Fellows majoring in internal medicine take a minimum of four services of six months each in clinical or laboratory diagnosis.

M151f,w,s,su. LABORATORY OF HEMATOLOGY AND URINALYSIS. DR. SANFORD.

M152f,w,s,su. GASTROLOGICAL LABORATORY. DR. SANFORD.

M153f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the gastro-intestinal and accessory digestive tracts. DR. EUSTERMAN, DR. BERKMAN, DR. HARTMAN, DR. McVICAR.

M154f,w,s,su. CLINICAL DEMONSTRATION of diseases of the gastro-intestinal and accessory digestive tracts. Twenty-four hours. DR. EUSTERMAN, DR. HARTMAN, DR. McVICAR.

M155f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the intestines. DR. LOGAN, DR. POLLOCK, DR. BUIE.

M156f,w,s,su. CLINICAL DEMONSTRATION of diseases of the intestines. Twenty-four hours. DR. LOGAN, DR. POLLOCK, DR. BUIE.

M157f,w,s,su. PROCTOLOGY. DR. LOGAN, DR. POLLOCK, DR. BUIE.

- M158f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the chest. DR. LEMON, DR. GAARDE, DR. SZLAPKA.
- M159f,w,s,su. CLINICAL DEMONSTRATION of diseases of the chest. Forty-eight hours. DR. LEMON, DR. GAARDE, DR. SZLAPKA.
- M160f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the blood and blood-forming organs. DR. GIFFIN, DR. BONTA, DR. CONNER.
- M161f,w,s,su. CLINICAL DEMONSTRATION of diseases of the blood and blood-forming organs. Twenty-four hours. DR. GIFFIN, DR. BONTA, DR. CONNER.
- M162f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to diseases of the cardiovascular system, ductless glands, and esophagus. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS, DR. VINSON.
- M163f,w,s,su. CLINICAL DEMONSTRATION of diseases of the thyroid. Twenty-four hours. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS.
- M164f,w,s,su. CLINICAL DEMONSTRATION of diseases of the cardiovascular system and esophagus. Twenty-four hours. DR. H. S. PLUMMER, DR. WILLIUS, DR. VINSON.
- M165f-w,w-s,s-su,su-f. DIAGNOSIS AND RESEARCH (clinical and laboratory) in cardiorenal and vascular and metabolic diseases. DR. ROWNTREE, DR. KEITH, DR. WILDER, DR. BROWN.
- M166f,w,s,su. CLINICAL DEMONSTRATION of cardiorenal, vascular, and metabolic diseases. Twenty-four hours. DR. ROWNTREE, DR. KEITH, DR. BROWN.
- M167f,w,s,su. CLINICAL DEMONSTRATION of pancreatitis and diabetes. Twenty-four hours. DR. WILDER.
- M168f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to gynecology. DR. STACY, DR. MELSON.
- M169f,w,s,su. RADIUM AND ROENTGEN THERAPY. DR. STACY, DR. BOWING, DR. DES JARDINS.
- M170f-w,w-s,s-su,su-f. GENERAL MEDICAL AND SURGICAL DIAGNOSIS with special reference to acute emergency conditions. DR. HALLENBECK, DR. PIPER, DR. LONG.
- M171f-w,w-s,s-su,su-f. GENERAL DIAGNOSIS IN NEUROLOGY AND PSYCHIATRY. DR. SHILDEN, DR. WOLTMANN, DR. MOERSCH.
- M172f,w,s,su. CLINICAL DEMONSTRATION of neurological diseases. Twenty-four hours. DR. SHILDEN, DR. WOLTMANN, DR. MOERSCH.

- M173f,w,s,su. GENERAL DIAGNOSIS with special reference to dermatology and syphilology. All day. DR. STOKES, DR. GOECKERMAN, DR. O'LEARY.
- M174f,w,s,su. CLINICAL DEMONSTRATION OF DERMATOLOGIC AND SYPHILOLOGIC MATERIAL. Twenty-hour hours. DR. STOKES, DR. GOECKERMAN, DR. O'LEARY.
- M251f,w,s,su. ADVANCED WORK IN ELECTROCARDIOGRAPHIC LABORATORY. DR. H. S. PLUMMER, DR. WILLIUS.
- M252f,w,s,su. METABOLIC LABORATORY. Respiratory exchange and allied physiologic problems. DR. BOOTHBY, DR. SANDIFORD.
- M253f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M153 or M155. Twelve hours. DR. EUSTERMAN, DR. HARTMAN, DR. MCVICAR.
- M254f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M156 and M157. Twenty-four hours. DR. LOGAN, DR. POLLOCK, DR. BUIE.
- M255f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M158. Sixty hours. DR. LEMON, DR. GAARDE, DR. SZLAPKA.
- M256f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M160. Twelve hours. DR. GIFFIN, DR. BONTA, DR. CONNER.
- M257f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M162, M251, or M252. Twelve hours. DR. H. S. PLUMMER, DR. BOOTHBY, DR. W. A. PLUMMER, DR. WILLIUS, DR. VINSON.
- M258f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M165. Twelve hours. DR. ROWNTREE, DR. KEITH, DR. WILDER, DR. BROWN.
- M259f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M168 or M170. Twelve hours. DR. HALLENBECK, DR. PIPER, DR. LONG.
- M260f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Courses M168 or M169. Twelve hours. DR. STACY.
- M261f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M171. Twelve hours. DR. SHELDEN, DR. WOLTMANN, DR. MOERSCH.
- M262f,w,s,su. SEMINAR. Open to fellows who have been or who now are enrolled in Course M173. Twenty-four hours. DR. STOKES, DR. GOECKERMAN, DR. O'LEARY.

M263f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies (in nephritis, acidosis, diseases of the liver and of the blood) together with research work along biochemical and metabolic lines. DR. ROWNTREE, DR. KEITH.

M264f,w,s,su. MEDICAL CHEMISTRY. Chemical and metabolic studies in diabetes, together with research work along biochemical lines. DR. WILDER.

M265f,w,s,su. RESEARCH IN MEDICINE. DR. ROWNTREE, DR. WILDER.

## OBSTETRICS AND GYNECOLOGY

Professor JENNINGS C. LITZENBERG; Associate Professors FRED L. ADAIR, JOHN L. ROTHROCK; Assistant Professor LEE W. BARRY.

Of the courses in other departments open to graduate medical students, the following are especially recommended for those desiring to specialize in obstetrics and gynecology.

Advanced Anatomy: gross and histological, of the female generative organs (Anatomy 153f-154w-155s-156su)

Fetal Anatomy: dissection of fetus and new-born (Anatomy 133f and 134f,s,su)

Implantation and Placentation (Anatomy 137f,w,s)

Advanced Physiologic Chemistry (Physiology 153f,w,s,su)

Gynecological Pathology (Pathology 118s)

Experimental Pharmacology (Pharmacology 104, 109a,b)

Other courses in fundamental or clinical subjects may be elected.

The following graduate courses are offered in the Department of Obstetrics and Gynecology (at Minneapolis):

117f-118w-119s-120su. ADVANCED PATHOLOGY OF THE FEMALE GENERATIVE ORGANS. Required of first- or second-year fellows in obstetrics and gynecology. Prerequisite: Pathology 108, or equivalent. DR. ADAIR.

121f-122w-123s-124su. CLINICAL OBSTETRICS AND GYNECOLOGY. A course in diagnosis and treatment, with special study of selected cases. Clinic in the Out-Patient Department of the University Hospital, MWF, throughout the year. Required of first-year fellows, and may be elected by second-year fellows. DR. LITZENBERG and staff.

125f-126w-127s-128su. CLINICAL OBSTETRICS AND GYNECOLOGY. Similar to Course 111-114, but on TThS. Required of second-year fellows, and may be elected by first-year fellows. DR. LITZENBERG and staff.

201f-202w-203s-204su. ADVANCED OBSTETRICS AND GYNECOLOGY. Includes service in the University Hospital, affording ample opportunity for experience in diagnosis, care, and treatment (operative and non-operative) of patients. Special facilities offered for study of problems and cases of unusual interest. Required of first-year fellows. DR. LITZENBERG.

205f-206w-207s-208su. Similar to Course 201-204, but more advanced, both in clinical and research aspects of the subjects, so as to be adapted to the increased training and experience. Required of second-year fellows. DR. LITZENBERG.

209f-210w-211s-212su. Similar to Courses 201-204 and 205-208 but more advanced. Required of third-year fellows. DR. LITZENBERG.

213f-214w-215s. SEMINAR. A conference, including the fellows and graduate students. Presentation and discussion of original work and reports upon the current literature in obstetrics and gynecology. Reading knowledge of French and German is necessary. DR. LITZENBERG.

216f-217w-218s-219su. RESEARCH. Clinical and laboratory research upon problems in obstetrics and gynecology. Required of third-year fellows, who must complete a satisfactory thesis during the year. Elective for second-year fellows or other properly qualified graduate students. DR. LITZENBERG, DR. ADAIR, DR. ROTHROCK, DR. BARRY.

### OPHTHALMOLOGY AND OTO-LARYNGOLOGY

Professors WILLIAM R. MURRAY, WILLIAM L. BENEDICT,\* HAROLD I. LILLIE,\* GORDON B. NEW;\* Associate Professor FRANK E. BURCH; Assistant Professor HORACE NEWHART; Instructors HORACE R. LYONS,\* AVERY D. PRANGEN.\*

The graduate courses in these subjects are designed to prepare selected men for advanced work in the various lines, to prepare them for practice in these specialties, and to develop research and productive work in these subjects.

Of elective courses in other departments, the following are highly desirable.

Physics of Light and Acoustics

Advanced Optics

Advanced Anatomy of the Head and Neck

Topographic Anatomy of the Head and Neck

Advanced Histology and Embryology of the Eye, Ear, Nose, and Throat

Advanced Physiology of the Vision and Hearing

Physiologic Optics Seminar

Special Pathology of the Eye, Ear, Nose, and Throat

Immunity

Advanced Neuropathology

The following courses are offered within the department:

#### A. COURSES OFFERED AT MINNEAPOLIS

124f. ANOMALIES OF THE OCULAR MUSCLES. DR. BURCH.

125w. COURSES ON VISUAL FIELD: PERIMETRY. DR. BURCH.

131f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE EYE. Demonstrations upon the cadaver and live and dead animal eyes, with the usual operative



procedures of practical value. Each graduate student will perform all the usual operations upon the cadaver and animals. Two and one-half hours a week. DR. MURRAY, DR. BURCH, DR. NEWHART.

- 132f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE NOSE AND THROAT. A course consisting of demonstrations upon the cadaver and the usual operative procedures of practical value. Each student will be given an opportunity to do work in the laboratory, performing all usual and practical operations. Two hours a week. DR. MURRAY, DR. NEWHART.
- 133f,w,s,su. ADVANCED OPERATIVE SURGERY OF THE TEMPORAL BONE. A course of eight to twelve hours consisting of demonstrations and exercises on the cadaver at the Institute of Anatomy. Limited to four students. DR. MURRAY, DR. NEWHART.
- 134f,w,s,su. OPERATIVE SURGERY ON THE LABYRINTH. A course consisting of lectures and practical demonstrations of diagnostic methods. Eight hours; Millard Hall. DR. MURRAY, DR. NEWHART.
- 135f,w,s,su. ADVANCED COURSE IN REFRACTION WORK. A course consisting of eight lectures and illustrated demonstrations upon the errors of refraction and motor anomalies, supplemental and practical work in out-patient clinic on the refraction work. DR. MURRAY, DR. BURCH.
- 138f,w,s,su. ADVANCED OPHTHALMOSCOPY. Training in the use of the ophthalmoscope by (a) direct method, and (b) indirect method. Examination in detail of the normal fundus oculi. Diagnosis of abnormalities (a) in the media, (b) in the fundus oculi. DR. MURRAY, DR. BURCH.
- 139f,w,s,su. ADVANCED OPHTHALMOLOGY. Three years' service in the wards and Out-Patient Department of the University Hospital with clinic and laboratory research. Those taking this course will act as assistants in out-patient clinics in operative and other clinical work. DR. MURRAY and assistants.
- 141f,w,s,su. ADVANCED OTO-LARYNGOLOGY. Three years' service in the wards of the University Hospital and Out-Patient Department with clinic and laboratory research. Those taking this course will act as assistants in out-patient clinics in operative and other clinical work. DR. MURRAY and assistants.
- 145f,w,s,su. CLINICAL OPHTHALMOLOGY AND OTO-LARYNGOLOGY. Special half-time assistantship and service in the private clinic of Associate Professor Burch. A systematic course of assigned reading and study with final examination, is included. For credit beyond one year, work in investigation must be included. DR. BURCH.
- 146s. DIAGNOSIS AND THERAPEUTICS OF DISEASES OF THE EAR. DR. NEWHART.
- 147f,w,s,su. PRACTICAL WORK IN REFRACTION. Prerequisite: Course 135. DR. MURRAY, DR. BURCH.

201f,w,s,su. SEMINAR IN OPHTHALMOLOGY AND OTO-LARYNGOLOGY. Given by members of the staff and open to fellows, scholars, and other properly qualified graduate students. DR. MURRAY, DR. BURCH, DR. NEWHART.

203f,w,s,su. RESEARCH. Each graduate student will be required to pursue some line of original research in ophthalmology or oto-laryngology. DR. MURRAY, DR. BURCH, DR. NEWHART.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

Fellows majoring in ophthalmology in the Mayo Foundation usually spend nine months on the physics of light, physiologic optics, and anatomy, pathology, and bacteriology of the eye in the Medical School in Minneapolis. The remainder of their service is composed of the following:

M151f,w,s,su. CLINICAL OPHTHALMOLOGY. External diseases of the eye, ophthalmoscopy, ophthalmic surgery. DR. BENEDICT.

M152f,w,s,su. REFRACTION AND OPHTHALMIC MYOLOGY. Theory of refraction, retinoscopy, diagnosis of refractive errors of the eye, prescribing of lenses, practical work on patients under supervision of instructor. Eye movements, disturbances of motility of the eyes. DR. PRANGEN.

M153f,w,s,su. MEDICAL OPHTHALMOLOGY. Ophthalmology in relation to general diseases. DR. BENEDICT.

M154f,w,s,su. NEURO-OPHTHALMOLOGY. Ophthalmology in relation to diseases of the nervous system. Physiology of the eye, psychology of vision, functional eye disturbances. DR. BENEDICT.

M155f,w,s,su. PATHOLOGY OF THE EYE. DR. BENEDICT.

NOTE: Laboratory facilities for research in pathology and bacteriology of the eye, animal experimentation; demonstrations; weekly seminars held jointly by sections on Ophthalmology, Oto-Laryngology and Rhinology, and Laryngology, oral and plastic.

Fellows majoring in oto-laryngology and rhinology in the Mayo Foundation usually spend the first year in laryngology, oral and plastic, the next nine months as interns in the Worrell Hospital where they act as second assistants in the operating rooms and in the examination of patients in the clinic. In the forenoons of the next nine months they are on out-patient service in the clinic, and in the afternoons they examine patients. In the forenoons of the next nine months they act as first assistants at operations in the Worrell Hospital and in the afternoon they examine patients. During this period they have special opportunity to do equilibration work. Service in the minor is taken as part-time service during all or part of the fellowship period.

M157f,w,s,su. CLINICAL OTO-LARYNGOLOGY AND RHINOLOGY. Theory and practice with differential diagnosis of diseases of the ear, nose, accessory sinuses, pharynx, and larynx and their relations to general diagnosis. Half-time for nine months. DR. LILLIE, DR. LYONS.

- MI58f,w,s,su. PREOPERATIVE AND POSTOPERATIVE CARE OF PATIENTS. Treatment of complications. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.
- MI59f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. Internship, second assistantship in operating service in Worrell Hospital. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.
- MI60f,w,s,su. OPERATIVE OTO-LARYNGOLOGY AND RHINOLOGY. First assistantship in operative service in Worrell Hospital. Half-time for nine months. DR. LILLIE, DR. BARLOW, DR. LYONS.
- MI61f,w,s,su. LARYNGOLOGY, ORAL AND PLASTIC. Clinical and surgical. Neoplasms of the nose, throat, mouth, and neck. Diagnosis of laryngeal pathology. Plastic surgery of the face, mouth, and neck. Radium treatment. DR. NEW.

### PATHOLOGY

Professors WILLIAM C. MACCARTY,\* ELEXIOUS T. BELL, HAROLD E. ROBERTSON,\* ARTHUR H. SANFORD,\* LOUIS B. WILSON,\* Associate Professors THOMAS B. MAGATH,\* ALBERT C. BRODERS,\* HAROLD S. DIEHL.

Graduate students who desire to take their major or minor work in pathology must present credit in the following subjects: physics, 8 credits; general and organic chemistry, 12 credits; zoology, 6 credits; and a reading knowledge of German.

In addition, students who elect their major work in pathology must present credits for the equivalent of the two years' work of the Medical School of this University.

#### A. COURSES OFFERED AT MINNEAPOLIS

- 103f. PREVENTIVE MEDICINE AND HYGIENE. A systematic study of the principles of personal and communal hygiene and of general procedures for the protection of the public health. Thirty-three hours; 3 credits. DR. DIEHL.
- 104f,w,s. AUTOPSIES. Technique of performing autopsies; making autopsy records; examination of fresh organs removed from these autopsies. Opportunities afforded to study observed lesions microscopically. Three or four students called to each post-mortem; excused from regular classes. The staff.

#### ELECTIVE COURSES<sup>1</sup>

106. PATHOLOGIC TECHNIQUE. General and special methods of preparation of microscopic and gross pathologic specimens; including practice with freezing microtome, celloidin and paraffin embedding methods, general and special stains, preparation of museum specimens, etc.

<sup>1</sup> Elective courses offered in two, three, or four quarters. Special programs issued for each quarter. Assignment of elective courses to individual staff members will appear in quarterly programs.

107f,w,s. APPLIED PATHOLOGY. Laboratory studies in the examination of routine operative and autopsy specimens, with investigation of special associated problems. Credit for work in this course is to be judged entirely by character and amount of work accomplished. Dates and hours arranged.

108. DIAGNOSIS OF TUMORS. The study of tumors and other pathologic conditions simulating tumor formation.

109. CLINICAL PATHOLOGICAL CONFERENCE. Presentation and comparison of clinical data on selected cases by clinicians, and of the pathological specimens from these same cases, by the pathologist, with discussions of the problems of etiology and diagnosis. One hour per week in each quarter.

Electives in coöperation with the respective clinical branches. Studies of the pathologic conditions found in the diseases peculiar to each of the specialties listed below. Lesions demonstrated by gross and microscopic specimens.

110. GYNECOLOGICAL PATHOLOGY.

111. NEUROPATHOLOGY.

112. PATHOLOGY OF DISEASES OF THE EYE, EAR, NOSE, AND THROAT.

113. PATHOLOGY OF DISEASES OF CHILDREN.

201. RESEARCH. Graduate students, of the necessary preliminary training, may elect research, either as majors or minors in pathology. Hours and credits to be arranged.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The graduate work in pathology offered in the Mayo Foundation is planned primarily to give opportunity to fellows majoring in clinical branches to study the pathological aspects of diseases in those fields in which they are specially interested. Opportunity is also offered for a small number of fellows to major in pathology with their minor in bacteriology, or vice versa.

M151f,w,s,su. PARASITOLOGY. Routine clinical and special research in parasitology, examination of stools, study of internal parasites. DR. MAGATH.

M152f,w,s,su. CLINICAL PATHOLOGY. Making and examination of cultures, preparation and administration of autogenous vaccines, Wasserman tests, special clinical and laboratory methods including hematology and serology and opportunity for research. DR. SANFORD.

M153f,w,s,su. LABORATORY DEMONSTRATION of clinical laboratory methods. DR. SANFORD, DR. MAGATH.

- M154f,w,s,su. CLINICAL CHEMISTRY. Studies in the newer methods of blood chemistry. DR. SANFORD, DR. MAGATH.
- M155f-w,w-s,s-su,su-f. NECROPSY SERVICE. Junior assistant three months; senior assistant three months; demonstrations in clinico-pathologic conferences; microscopic examination of fixed tissues removed at necropsy and operations. Weekly seminar. DR. ROBERTSON.
- M156f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at necropsy and operation. DR. ROBERTSON.
- M157f-w,w-s,s-su,su-f. SURGICAL PATHOLOGY. Pathologic diagnosis of surgical specimens at operation, gross and microscopic; study of fresh tissues. DR. MACCARTY, DR. BRODERS.
- M158f,w,s,su. LABORATORY DEMONSTRATION of tissue removed at operation. DR. MACCARTY, DR. BRODERS.
- M251f,w,s,su. RESEARCH STUDIES IN SPECIAL PATHOLOGY; special pathology of various organs; gross and microscopic study of lesions; research work on assigned problems in the several fields. DR. WILSON.
- M252f,w,s,su. RESEARCH STUDIES upon the etiology of neoplasms and clinico-pathologic standardization. DR. MACCARTY, DR. BRODERS.
- M253f,w,s,su. RESEARCH WORK on assigned problems in experimental pathology. DR. MANN.
- M254f,w,s,su. RESEARCH WORK in clinical pathology. DR. SANFORD, DR. MAGATH.

### PEDIATRICS

Professors HENRY F. HELMHOLZ,\* JULIUS P. SEDGWICK; Associate Professors SAMUEL AMBERG,\* WALTER R. RAMSEY, FREDERICK C. RODDA; Assistant Professors EDGAR J. HUENEKENS, MAX SEHAM, ROOD TAYLOR; Instructor NABOTH O. PEARCE.

The graduate work of the Department of Pediatrics is arranged with the intention (a) of preparing students to become competent pediatricists; (b) to put them in position to attack original pediatric problems; and (c) to make them competent teachers in the subject.

As a prerequisite a general understanding of physiologic and analytic chemistry and a working knowledge of French and German are essential.

Prospective students will find preparatory study in physiology and quantitative analysis of value.

Students will be encouraged to carry a minor in some of the fundamental branches.

### A. COURSES OFFERED AT MINNEAPOLIS

The following electives in other departments are desirable. (For further information see description of courses under departmental headings.)



- Quantitative Analysis
- Organic Chemistry
- Physical Chemistry
- Mental Retardation
- Physiologic Chemistry
- Physiology of Muscle, Nerve, Blood, Circulation, and Digestion
- Physiology of the Nervous System and Special Senses: Respiration, Metabolism, Nutrition, and Excretion
- Physical Chemistry of Cells
- Electrophysiology
- Metabolism
- Quantitative Methods
- Human Neurology
- Fetal Anatomy
- General Roentgenologic Technique
- Interpretations of Roentgenologic Findings
- Hematology
- Course in Immunity
- The Physiological and Chemical Basis of Pharmacology (Pharmacology 113)
- Diseases of Cardiovascular Apparatus (Medicine 123-124)
- Medical Chemistry
- Orthopedic Service
- Orthopedic Diagnosis
- Advanced Ophthalmoscopy
- 103f,w,s,su. CLINIC IN PEDIATRICS. Conducted at the University Hospital and the General Hospital; a part of course in required clinics.
- 104f,w,s,su. CONTAGIOUS DISEASES. The advanced study of contagious diseases, including the practice of intubation and tracheotomy, with training upon the cadaver.
- 111f,w,s,su. DISEASES OF THE NEW-BORN.
- 115f,w,s,su. THEORY AND PRACTICE OF INFANT-FEEDING, including diseases of the gastro-intestinal tract.
- 117f,w,s,su. PEDIATRIC CLINIC. Out-Patient clinic; University Hospital.
- 125f,w,s,su. SPECIAL GRADUATE CONTAGIOUS COURSE. Advanced study of contagious diseases, including practice of intubation with training upon the cadaver and the living dog. Limited to graduates.
- 127f,w,s,su. THESIS COURSE.
- 129f,w,s,su. PEDIATRICS SEMINAR.
- 130f,w,s,su. Course consisting of three to twelve months' residency in pediatrics and contagious diseases at General Hospital.
- 142f,w,s,su. PREPARATION OF INFANT FOODS. Practical work.

- 144f,w,s,su. *CONTAGIOUS DISEASES*. Advanced study of contagious diseases.
- 200f,w,s,su. *ADVANCED STUDY IN DISEASES OF INFANTS AND CHILDREN*.
- 202f,w,s,su. *RESEARCH IN DISEASES OF NEW-BORN*. Students undertaking this work should have had the equivalent of Fetal Anatomy and Pediatrics III.
- 204f,w,s,su. *RESEARCH IN PHYSIOLOGY OF NEW-BORN*. Prerequisite: Pediatrics III. Prerequisite preparation in physiology will depend upon the type of work undertaken.
- 206f,w,s,su. *RESEARCH IN DISEASES OF INFANTS AND GROWING CHILDREN*. Prerequisite work will depend upon the type of work undertaken.
- 208f,w,s,su. *RESEARCH IN PHYSIOLOGY OF INFANTS AND GROWING CHILDREN*. Prerequisite preparation will depend upon the type of work undertaken.
- 210f,w,s,su. *RESEARCH IN ANATOMY OF INFANTS AND GROWING CHILDREN*. Prerequisite preparation will depend upon the type of work undertaken.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities offered in pediatrics in the Mayo Foundation are designed for the purpose of training a few selected men for the special practice of pediatrics. The courses are also valuable to students majoring in special clinical fields.

- M151f-w,w-s,s-su,su-f. *DIAGNOSIS OF MEDICAL AND SURGICAL DISEASES OF INFANCY AND CHILDHOOD*. DR. HELMHOLZ, DR. AMBERG.
- M152f,w,s,su. *CLINICAL DEMONSTRATION of diseases of infancy and childhood*. Twenty-four hours. DR. HELMHOLZ, DR. AMBERG.
- M153f-w,w-s,s-su,su-f. *PREVENTIVE PEDIATRICS*. Twenty-four hours. Limited to two fellows. DR. HELMHOLZ, DR. AMBERG.
- M251f,w,s,su. *SEMINAR*. Open to fellows who have been or who now are enrolled in Course M151. DR. HELMHOLZ, DR. AMBERG.
- M252f-w,w-s,s-su,su-f. *RESEARCH IN DISEASES OF INFANCY AND CHILDHOOD*. DR. HELMHOLZ, DR. AMBERG.

#### PHARMACOLOGY AND THERAPEUTICS

Professor ARTHUR D. HIRSCHFELDER; Associate Professor EDGAR D. BROWN.

- 102S. *GENERAL PHARMACOLOGY*. The principles underlying the structure, physicochemical properties, physiologic, therapeutic, and toxic action of substances, natural or synthetic, used as medicines. At least one quarter of physiology is prerequisite. Twenty-two hours. DR. HIRSCHFELDER, DR. BROWN.

- 104s. EXPERIMENTAL PHARMACOLOGY. Exercises illustrating the preparation and actions of medicine, their relation to chemical structure and their mode of administration. At least one quarter of physiology is prerequisite. Sixty-six hours. DR. HIRSCHFELDER, DR. BROWN.
- 105su,f or w,s. GENERAL PHARMACOLOGY AND THERAPEUTICS. A more detailed study of drugs important in clinical practice, covering the relations of chemical structure to physiologic and therapeutic action and modes of application in clinical medicine. Sixty-four hours. DR. HIRSCHFELDER, DR. BROWN.
108. MEDICAL PRESCRIPTION WRITING. The study of crude drugs, pharmaceutical preparations, and the flavoring and compounding of prescriptions. Eight hours. DR. BROWN.
109. PHARMACOLOGICAL PROBLEMS. Special investigations and experimental study of one or more of the following topics: anesthetics; circulatory stimulants and depressants; drugs acting upon the kidneys; urinary antiseptics; poisons and antidotes; effects of common harmless drugs; internal secretions; action of drugs upon parasites, tumors, etc. Hours and credits by arrangement. DR. HIRSCHFELDER, DR. BROWN.
110. POISONS. Their detection, actions, and antidotes. Forty-eight hours. DR. BROWN.
- 201f,w,s,su. SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY. Reviews of recent literature bearing upon physiologic and pharmacologic subjects. Conducted by department directors, with the collaboration of the staffs and of qualified graduate or undergraduate students. Thirty-two hours.
- 203f,w,s,su. RESEARCH IN PHARMACOLOGY. DR. HIRSCHFELDER, DR. BROWN.

## PHYSIOLOGY AND PHYSIOLOGIC CHEMISTRY

Professors EDWARD C. KENDALL,\* ELIAS P. LYON, JESSE F. MCCLENDON, FREDERICK H. SCOTT; Associate Professors RICHARD O. BEARD, FRANCIS B. KINGSBURY, CHAUNCEY J. V. PETTIBONE.

The Department of Physiology is well equipped for the various types of physiologic investigation. The library facilities are good.

For a minor or major in physiology, good courses in general zoology, general chemistry, organic chemistry, and college physics, are prerequisites. (In exceptional cases high school physics may be accepted for a minor.) Physical chemistry is desirable.

For a minor or major in physiologic chemistry, general chemistry and organic chemistry are prerequisite, and physical chemistry and biology are desirable.

In addition, each student majoring in physiology or physiologic chemistry must have had the general courses, Physiology 100, 101, 103, 104, or the equivalent.

Students majoring in clinical subjects, and who desire to minor in physiology or physiologic chemistry, must have had the courses in these branches usually required of medical students.

A reading knowledge of German or French is required of candidates for the Master's degree in this department, and a reading knowledge of both French and German, of candidates for the Doctor's degree.

#### A. COURSES OFFERED AT MINNEAPOLIS

- 100f,su-101w,su. **PHYSIOLOGIC CHEMISTRY.** The components of the animal body; foods, digestion, the excreta, and metabolism. Third-year medical students and others. Prerequisite: organic chemistry. One hundred ninety-eight hours; 12 credits. DR. MCCLENDON, DR. KINGSBURY, DR. PETTIBONE.
- 103f,su. **PHYSIOLOGY OF MUSCLE, NERVE, BLOOD, CIRCULATION, AND DIGESTION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. DR. LYON, DR. SCOTT, and assistants.
- 104w,su. **PHYSIOLOGY OF THE NERVOUS SYSTEM AND SPECIAL SENSES; RESPIRATION, METABOLISM, NUTRITION, AND EXCRETION.** Fourth-year medical students and others. Prerequisites: organic chemistry and animal biology. One hundred twenty-one hours; 8 credits. DR. LYON, DR. SCOTT, DR. BEARD.
- 108f. **SEMINAR IN PHYSIOLOGIC OPTICS.** For graduate and medical students. Twenty-two hours; 2 credits. DR. LYON.
- 110f. **PHYSIOLOGIC OPTICS.** A laboratory course. For graduate and medical students. Thirty-three hours; 1 credit. DR. LYON.
- 113f,w,s,su. **PROBLEMS IN PHYSIOLOGY.** Arranged by instructors with qualified students. Each student will be assigned a topic for special laboratory study, leading in some cases to original investigation. Conferences and reading. Prerequisites: Course 103-104 or equivalent. Sixty-six hours; 3 credits or arrange. DR. LYON, DR. SCOTT.
- 115s. **APPLIED PHYSIOLOGY.** The application of physiology as a basis for interpretation of symptoms and signs of abnormal function. Three lectures weekly. Three credits.
- 131w. **ADVANCED PHYSIOLOGY OF MUSCLE, BLOOD, CIRCULATION, AND DIGESTION.** Alterations due to physiologic conditions. Prerequisite: Physiology 103. Sixty-six hours; 3 credits. DR. SCOTT.
- 153f,w,s,su. **ADVANCED PHYSIOLOGIC CHEMISTRY.** Course arranged by instructors with qualified students for special work. May be taken one or more quarters. Prerequisite: Course 100-101. Hours and credits arranged. DR. MCCLENDON, DR. KINGSBURY, DR. PETTIBONE.

- 155f. CHEMISTRY OF INFANT-FEEDING. Rôle of vitamins, proteins, and inorganic constituents in nutrition; preservation of food to preserve vitamins; effect of vitamin deficiency on mineral metabolism; chemistry of scurvy, beriberi, rickets, and pellagra. Twenty-two hours; 2 credits. DR. McCLENDON.
- 162w. CHEMICAL ANALYSIS OF BLOOD. The most recent methods in chemical analysis of blood. Limited to twelve students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. DR. KINGSBURY.
- 163s. METABOLISM. Lectures and laboratory work on special phases of metabolism. Lectures may be taken alone; number of students unlimited; laboratory course limited to ten students. Prerequisite: Physiology 101. Sixty-six hours; 3 credits. DR. PETTIBONE.
- 201f,w,s. SEMINAR IN PHYSIOLOGY AND PHARMACOLOGY. For instructors and advanced students. Eleven hours; 1 credit. DR. HIRSCHFELDER, DR. LYON, and staff.
- 203f,w,s,su. RESEARCH IN PHYSIOLOGY. Hours and credits arranged. DR. LYON, DR. SCOTT.
- 205f,w,s,su. RESEARCH IN PHYSIOLOGIC CHEMISTRY. Hours and credits arranged. DR. McCLENDON, DR. KINGSBURY, DR. PETTIBONE.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

- M251f,w,s,su. PHYSIOLOGIC CHEMISTRY. Research work in problems related to metabolism; includes training in the use of methods of organic and inorganic analysis. DR. KENDALL, MR. OSTERBERG.

NOTE: For course in applied physiology, see announcement of the Department of Surgery. For courses in medical chemistry, see announcement of the Department of Medicine. For courses in clinical chemistry, see announcement of the Department of Pathology.

#### PREVENTIVE MEDICINE AND PUBLIC HEALTH

Professor LEVERETT D. BRISTOL; Associate Professor ALBERT J. CHESLEY; Assistant Professors HAROLD S. DIEHL, ORIANNA McDANIEL, E. M. WADE, H. A. WHITTAKER.

Inquiries concerning other work in public health should be addressed to the director, Dr. H. S. Diehl, Millard Hall, Minneapolis.

101. INDUSTRIAL HYGIENE AND INDUSTRIAL MEDICINE. Physical examinations; working conditions—lighting, ventilation, noise, dust; industrial poisons; accidents; recreation; education; economic conditions; medical and nursing service, industrial insurance. Open only to fifth- and sixth-year medical students and graduates. DR. BRISTOL.



102. **SANITATION.** Sanitary supervision of water and milk supplies, sewerage systems and sewage, refuse, and garbage disposal systems. Practical work including field investigations, laboratory examinations, interpretation of results, recommendations to correct unsatisfactory conditions, report-writing and office procedure. Open only to graduate students who have had Bacteriology 101; Chemistry 20-21, 35-36; Physics 22, 32, 42. Credits arranged. MR. WHITTAKER.
103. **PUBLIC HEALTH BACTERIOLOGY.** Modern methods of a public health laboratory in making diagnoses; in the preparation of vaccines, and in research. Prerequisites: Bacteriology 101, 106. Credits arranged. MISS WADE.
104. **EPIDEMIOLOGY.** Lectures on principles and methods of epidemiological investigation. Analysis of data; methods of reaching conclusions; individual field work; collateral reading. Open only to graduate medical students. Credits arranged. DR. CHESLEY, DR. McDANIEL.
105. **VITAL STATISTICS.** Application of statistical methods to morbidity and mortality figures; births and deaths; the drawing of conclusions; preparation of tables and graphs; measurement of effectiveness of health activities; calculation of expectancy; actual experience with the State Board of Health. Prerequisites: 51 and Econ. 14. Credits arranged. DR. CHESLEY.
106. **PUBLIC HEALTH ADMINISTRATION.** Organization of state, municipal, and voluntary health activities; preparation of budgets; procedures in enforcing quarantine; in correcting unsanitary conditions; in controlling tuberculosis and venereal diseases; value of sanitary surveys, food inspections, etc. Prerequisite: 54 or 56. Credits arranged. DR. DIEHL, DR. CHESLEY.
108. **FIELD WORK IN PUBLIC HEALTH.** This will consist of actual health work, under supervision, in one or more of the approved public health organizations. The time, assignment, and credits will be arranged. Prerequisite: 104 or 106.
201. **RESEARCH.** Opportunities will be offered by the University and by the various coördinated organizations for qualified students to pursue research work. DR. DIEHL, DR. BRISTOL, DR. CHESLEY.

#### ADDITIONAL COURSES

Other courses offered in this and the Graduate School bulletins which bear on work in public health:

Department	Course Title	Course Number
Animal Biology	Protozoology .....	107
Economics	Theory of Statistics.....	113
Chemistry	Sanitary Water Analysis.....	126
Political Science	Government of Minnesota.....	111
Psychology	Social Psychology .....	127

Department	Course Title	Course Number
Sociology	Methods of Social Investigation.....	122
Education	Elementary Educational Psychology.....	139
Education	Mental Tests and Mental Diagnosis.....	135-136
Physiology	Physiology .....	101-102- 103-104
Pathology	Pathology .....	101-102
Bacteriology and Immunology	Special Bacteriology .....	101
Bacteriology and Immunology	Household Bacteriology .....	105
Bacteriology and Immunology	Higher Bacteria .....	114
Bacteriology and Immunology	Immunity .....	116
Engineering	Water Supply Engineering.....	162
Engineering	Sanitary Engineering .....	163
Engineering	Water and Sewage Purification.....	261

## ROENTGENOLOGY

Professor RUSSELL D. CARMAN;\* Associate Professor ALEXANDER B. MOORE;\* Instructors HOWARD O. STEARNS,\* CHARLES G. SUTHERLAND.\*

The opportunities offered in roentgenology in the Mayo Foundation are designed to permit selected men to fit themselves for advanced work in this specialty. The courses are also especially valuable for men who take them as minors in their preparation for special clinical fields. Unless the prospective student's preparation in normal anatomy, physiology, and pathology has been unusually good, at least a year should be spent in intensive study of these subjects before entering on the special three years' course.

MI51f,w,s,su. GENERAL ROENTGENOLOGIC TECHNIQUE. Roentgenography; plates, intensifying screens, developers; stereoscopy; roentgenoscopy; vertical, horizontal. DR. CARMAN, DR. MOORE, DR. SUTHERLAND.

MI52f,w,s,su. SPECIAL APPLICATION OF ROENTGENOLOGY. The osseous system, chest and lungs, urinary system, pyelography; gastro-intestinal tract. DR. CARMAN, DR. MOORE, DR. SUTHERLAND.

MI53f,w,s,su. ROENTGEN THERAPY. Superficial, deep; technique; apparatus; filters; dosage and measurements; cross firing; protection. DR. CARMAN, DR. MOORE.

MI54f,w,s,su. DANGERS OF THE ROENTGEN RAY. Effect upon tissues, normal and pathologic; protection, operator, patient; roentgen dermatitis, cause, results, treatment. DR. CARMAN, DR. MOORE.

MI55f,w,s,su. DEMONSTRATION of roentgenologic interpretation. DR. CARMAN, DR. MOORE.

MI56f,w,s,su. DEMONSTRATION of treatment by roentgen ray and radium. DR. CARMAN.

- M251f,w,s,su. **ELECTROPHYSICS.** Electricity and magnetism, phenomena, nature, and properties; source of electric energy; types of currents, continuous and alternating; units of electric measurement; resistance; Ohm's law; voltage, amperage, and wattage; the static machine; the induction coil; interrupters; condensers; the interrupterless transformer. MR. STEARNS.
- M252f,w,s,su. **PHYSICS OF THE ROENTGEN RAY.** History, nature, and phenomena; the vacuum tube; the roentgen tube; types, penetration, measurements. MR. STEARNS.
- M257f,w,s,su. **INTERPRETATION OF ROENTGENOLOGIC FINDINGS.** Normal, abnormal; roentgen signs of disease, direct, indirect; correlation of plate and screen observations; correlation of clinical and roentgen findings. DR. CARMAN, DR. MOORE.

## SURGERY

(Including Divisions of General Surgery, Experimental Surgery, Orthopedic Surgery, Urology, and Dental Surgery.)

Professors WILLIAM F. BRAASCH,\* MELVIN S. HENDERSON,\* E. STARR JUDD,\* FRANK C. MANN,\* CHARLES H. MAYO,\* ARTHUR C. STRACHAUER; Associate Professors DONALD C. BALFOUR,\* J. FRANK CORBETT, WARREN A. DENNIS, BOYD S. GARDNER,\* ARTHUR A. LAW, WILLIAM LERCHE, ARTHUR T. MANN, HARRY P. RITCHIE, WALTER E. SISTRUNK,\* FRANKLIN R. WRIGHT; Assistant Professors H. CAREY BUMPUS,\* ANGUS L. CAMERON, CARL C. CHATTERTON, JOHN L. CRENSHAW,\* EMIL S. GEIST, CARL A. HEDBLUM,\* VERNE C. HUNT,\* JAMES C. MASSON,\* HENRY W. MEYERDING,\* JOHN DE J. PEMBERTON,\* GILBERT J. THOMAS; Instructors ALFRED W. ADSON,\* STUART W. HARRINGTON,\* FREDERICK L. SMITH.\*

Dr. William J. Mayo, being a regent of the University, is not a member of the instructional staff. His services in instruction and conference, however, are available.

### A. COURSES OFFERED AT MINNEAPOLIS

- 101f,w,s. **ADVANCED MINOR SURGERY.** The student is required to assist in the out-patient surgical clinic, and in this connection makes a special study of the diagnosis and treatment of selected cases. DR. STRACHAUER.
- 102f,w,s. **OPERATIVE SURGERY ON THE CADAVER.** Technique of abdominal incision and closure; of bowel suturing, appendix removal, kidney exploration, nephrotomy, tracheotomy, amputations, ligations, etc. Graduate students act as laboratory assistants, and may work out upon the cadaver various independent problems in emergency surgery. DR. CAMERON.
- 103f,w,s. **OPERATIVE SURGICAL TECHNIQUE.** A study of surgical technique by cardinal operations upon living animals. DR. CAMERON.

- 105f,w,s. PROCTOSCOPY AND SIGMOIDOSCOPY. The treatment and diagnosis of the pathological conditions found in the lower bowel, including minor surgical operations. DR. STRACHAUER.
- 201w,s. SURGERY OF THE KIDNEY. Review of the embryology, anatomy, and pathology. Diagnosis, cystoscopic study, including kidney function estimation and pyelography; operative technique. Study of special problems involved. DR. STRACHAUER, DR. THOMAS.
- 204w,s. SURGERY OF THE BRAIN AND SPINAL CORD. Operative technique; study of special problems involved. Prerequisites: Anatomy 103, Medicine 125. DR. STRACHAUER.
- 205f-206w-207s. SURGICAL DIAGNOSIS. In this course the graduate student assists in the practical instruction of the clinical clerks and interns in the University Hospital, and makes a special study of problems in surgical diagnosis. DR. STRACHAUER, DR. LAW, DR. RITCHIE.
- 208f-209w-210s. SURGICAL SERVICE. The graduate student acts as house surgeon, and in connection with the service is required to make a special study of the patients, preparing them for clinics and observing them after operations. DR. STRACHAUER, DR. LAW, DR. RITCHIE.
- 211f-212w-213s. OPERATIVE SURGERY. In this course the surgical fellow acts as first assistant at all operations by the surgical staff in the University Hospital. When properly qualified, the fellow will be permitted to operate, beginning with simpler surgical procedures. DR. STRACHAUER, DR. LAW, DR. RITCHIE.
- 214f,w,s. ORTHOPEDIC SERVICE. Three months' service as house surgeon in the State Hospital for Crippled and Deformed Children at Phalen Park. Special facilities for the study of orthopedic diagnosis and treatment. DR. CHATTERTON.
- 215f,w,s. ORTHOPEDIC DIAGNOSIS AND TREATMENT. History-taking, physical examination, treatment, application and use of plaster of Paris casts and braces. The graduate student acts as assistant in the clinic. DR. GEIST.
- 216f,w,s. SURGICAL RESEARCH. Properly qualified students may undertake original investigation of problems in either experimental or clinical surgery. The work may be used for thesis purposes. DR. STRACHAUER, DR. CAMERON.
- 217f,w,s. SURGICAL SEMINAR. Conference for reports on surgical literature, with presentation and discussion of specially interesting cases and research work by members of the surgical staff. DR. STRACHAUER, DR. CAMERON.

218f,w,s. UROLOGIC DIAGNOSIS. History-taking, physical examination, and case study in diseases of the genito-urinary tract. DR. WRIGHT, DR. THOMAS.

219f,w,s. CYSTOSCOPY AND URETHROSCOPY. Cystoscopic examination; urethral catheterization; kidney function study; pyelography; intra-vesical operations; fulguration. DR. WRIGHT, DR. THOMAS.

#### B. COURSES OFFERED AT ROCHESTER (MAYO FOUNDATION)

The opportunities for preparation in surgery in the Mayo Foundation are found largely in pathology, surgical diagnosis, and operative surgery. For work in pathology, see the Department of Pathology. For the work in surgical diagnosis, see the Department of Medicine. In the operative service the fellow acts as second assistant every second day for a period of one year. On the alternate days he is charged with the post-operative care of all the patients in the operating room in which he is on service. Selected men of the highest attainments are given opportunity for one additional year of first assisting. In all instances, attempt is made to give the most of the best service to the best men. Fellows majoring in surgery take a minimum of two services of six months in diagnosis.

Fellows majoring in orthopedic surgery usually take a minor in pathology (see Department of Pathology), one year in orthopedic diagnosis, and one year or more in orthopedic surgery.

Fellows majoring in urology usually take their minor (six months) in pathology, and a half minor (three months) in syphilology (see Course M175, Medicine). Their diagnostic service consists of twelve months in cystoscopy and urethroscopy, and six months in the hospital care of urologic cases. Their surgical work covers nine months in surgery of the abdominal and genito-urinary organs (see Course M153, Surgery).

M151f,w,s,su. LABORATORY DEMONSTRATION of surgical technique. DR. MANN.

M152f,w,s,su. POSTOPERATIVE CARE OF PATIENTS; treatment of complications, surgical and medical. DR. SISTRUNK, DR. SMITH.

M153f,w,w-s,s-su,su-f. OPERATIVE SURGERY. Second assistantship in operating rooms; occasional substitute service as first assistant. DR. MAYO, DR. JUDD, DR. BALFOUR, DR. SISTRUNK, DR. HEDBLOM, DR. HUNT, DR. MASSON, DR. PEMBERTON, DR. ADSON, DR. HARRINGTON.

M154f,w,s,su. SURGERY OF THE ABDOMINAL ORGANS AND THE DUCTLESS GLANDS. Operative technique; study of special problems involved. DR. MAYO.

M155f,w,s,su. SURGERY OF THE ABDOMINAL AND GENITO-URINARY ORGANS. Operative technique; study of special problems involved. DR. JUDD.

M156f,w,s,su. SURGERY OF THE GASTRO-INTESTINAL TRACT AND PELVIC ORGANS. Operative technique; study of special surgical problems. DR. BALFOUR.



- M157f,w,s,su. SURGERY OF THE THORACIC ORGANS. Operative technique; study of special problems involved. DR. HEDBLUM.
- M158f,w,s,su. ORTHOPEDIC DIAGNOSIS. History-taking and physical examination of orthopedic cases. Study of braces, material and construction, measurement and fitting; application and use of plaster of Paris; radiography of orthopedic cases; care of non-surgical orthopedic cases. DR. HENDERSON, DR. MEYERDING, DR. CHAMBERS.
- M159f,w,s,su. ORTHOPEDIC SURGERY. One year of service is offered for those desiring special training in orthopedic surgery. DR. HENDERSON, DR. MEYERDING.
- M160f,w,s,su. DEMONSTRATION OF ORTHOPEDIC CASES. Twenty-four hours. DR. HENDERSON, DR. MEYERDING.
- M161f-w,w-s,s-su,f. UROLOGIC DIAGNOSIS. Cystoscopic examination and history-taking in diseases of the genito-urinary tract. DR. BRAASCH, DR. CRENSHAW, DR. BUMPUS.
- M162f,w,s,su. CYSTOSCOPY, URETHROSCOPY. Cystoscopic examination; pyelography; intravesical operations; fulguration. DR. BRAASCH, DR. CRENSHAW, DR. BUMPUS. One year or more of service is offered as a part of a three-year fellowship for those desiring to specialize in urology.
- M163f,w,s,su. DEMONSTRATION OF UROLOGIC CASES. Twenty-four hours. DR. BRAASCH, DR. BUMPUS, DR. CRENSHAW.
- M164f,w,s,su. GENERAL ADVANCED PHYSIOLOGY with physical application. Preparatory to Course M165. DR. MANN.
- M165f,w,s,su. APPLIED PHYSIOLOGY. Experimental physiology as applied to surgical problems. Open to fellows in surgery, medicine, and pathology. DR. MANN.
- M251f,w,s,su. APPLIED PATHOLOGY. Experimental pathology as applied to surgical problems. Open to fellows in pathology, medicine, and surgery. DR. MANN.
- M252f,w,s,su. SURGICAL RESEARCH. Investigation of special problems in surgery. Open only to fellows of the department. DR. MANN.
- M253f,w,s,su. SURGICAL SEMINAR. Conference for the discussion of original work, problems, and surgical literature. Staff.
- M254f,w,s,su. SEMINAR IN ORTHOPEDIC SURGERY. Open to fellows of the department. Twelve hours. DR. HENDERSON.
- M255f,w,s,su. SEMINAR IN UROLOGY. Open to fellows of the department. Twelve hours. DR. BRAASCH.  
Work is also offered in dental surgery under DR. BOYD S. GARDNER.

NOTE: For courses in surgical anatomy, pathology, clinical diagnosis, surgery of the eye, ear, nose, and throat, and roentgen plate-reading, see announcements of corresponding departments.





